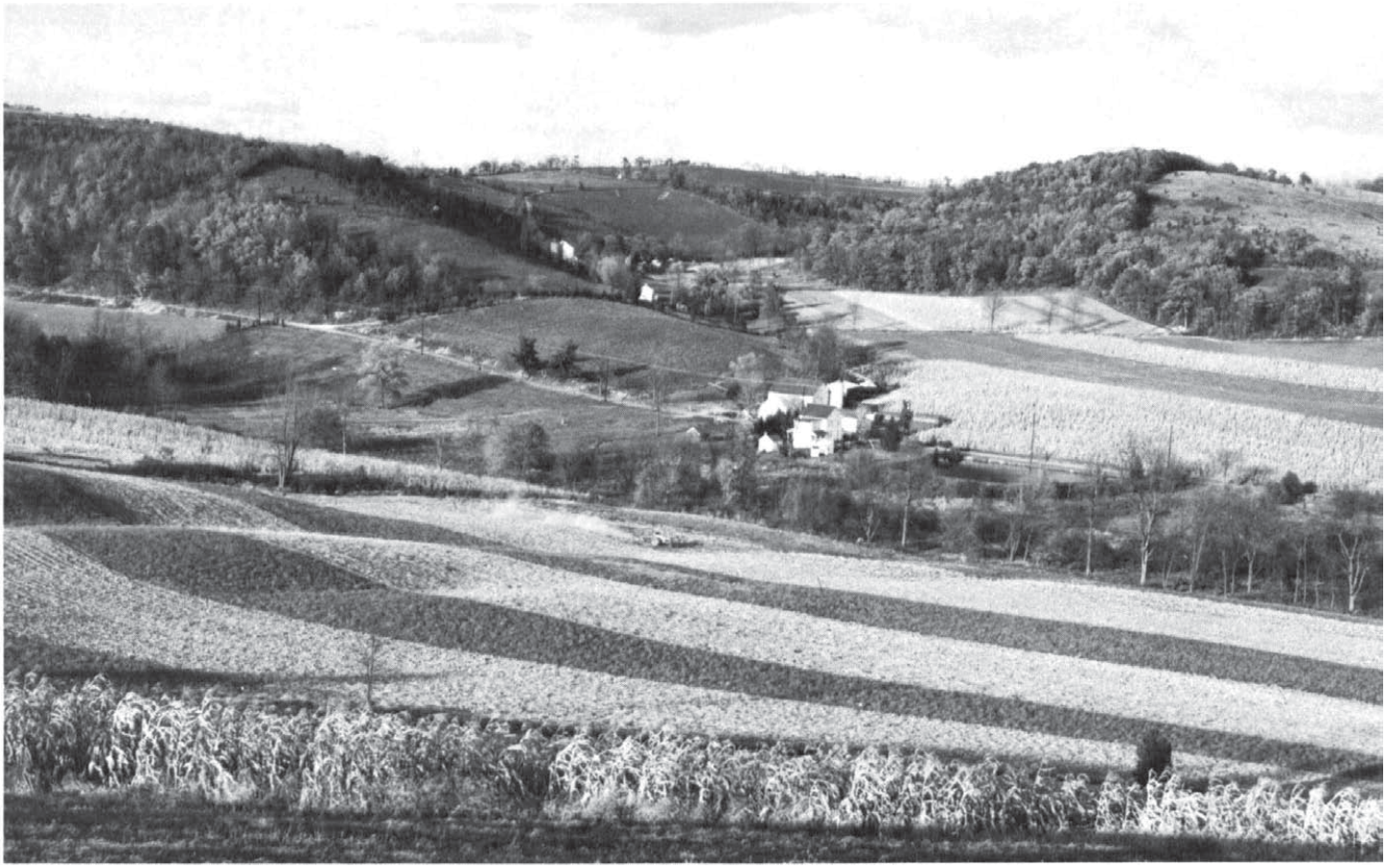
SOIL SURVEY OF

Northampton County Pennsylvania



United States Department of Agriculture
Soil Conservation Service
In cooperation with
The Pennsylvania State University
College of Agriculture and the Pennsylvania
Department of Environmental Resources
State Conservation Commission

Issued July 1974

Major fieldwork for this soil survey was done in the period 1964-69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service and the Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Conservation Commission. It is part of the technical assistance furnished to the Northampton County Conservation District. Financial assistance was provided by the Northampton County Board of Commissioners and by the Department of Housing and Urban Development, under the provisions of section 701 of the Housing Act of 1954, as amended.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D. C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of Northampton County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Use of the Soils as Woodland," where a table shows the relative suitability of the soils for growing trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers to the county may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County" and in the information about the county given at the beginning of the publication.

Cover: Area in the Berks-Weikert soil association near Richmond, in the northeastern part of Northampton County. Weikert soils are on the hills in the background; Berks soils are in the stripcropped fields in the foreground.

Contents

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SOIL SURVEY OF NORTHAMPTON COUNTY, PENNSYLVANIA

BY LARRY R. STALEY

FIELD SURVEY BY LARRY R. STALEY, E. A. TOMPKINS, T. J. BUSHONG, AND H. J. HIXSON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURE, AND PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES, STATE CONSERVATION COMMISSION.

NORTHAMPTON COUNTY is located on the western fringe of the megalopolis that characterizes the eastern seaboard. It is an industrialized, urban county located in southeastern Pennsylvania (fig. 1). The county is on the extreme eastern border of Pennsylvania and is separated from Warren County, New Jersey, by the Delaware River. The county has a total area of 374 square miles or 239,360 acres. Census data in 1970 showed a population of 214,368 for the county. Bethlehem, with a population of 72,686, and Easton, with a population of 30,256 were the two largest cities in 1970. More than 15 million people live within a 100-mile radius of Easton, the county seat. Driving time to Philadelphia and New York City is about 1 1/2 hours.

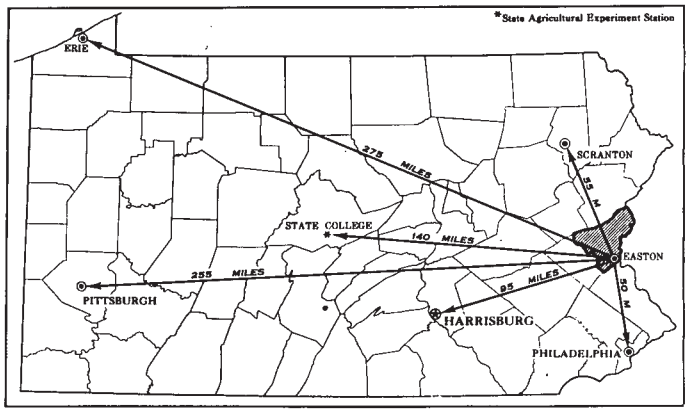

Figure 1.—Location of Northampton County in Pennsylvania.

Northampton County is drained by the Lehigh and Delaware Rivers and their tributaries. The entire county is within the Delaware River Basin. A broad valley, approximately 18 miles wide, extends across the center of the county. Within this valley is a belt of limestone about 10 miles wide, which has weathered to form the productive soils that attracted the first settlers from Philadelphia. The climate is mild; the average annual temperature is 50° F.

The county is easily reached by highway, rail, and air. It is serviced by the Allentown-Bethlehem-Easton Airport and eight railroads. Interstate Highway 78 runs east to west across the county. The construction of proposed interstate highways will further improve transportation facilities. Also servicing the area are 44 motor freight lines and seven bus lines.

Many religious, medical, and educational facilities are available in the county and in the neighboring counties of Lehigh and Bucks. Recreational facilities, somewhat neglected in the past, are being rapidly expanded. The Pennsylvania FishCommission recently completed Lake Minsi, a 122-acre fishing area east of North Bangor in Upper Mount Bethel Township. The Delaware Water Gap National Recreational Area includes approximately 1,000 acres of park land in the extreme northeastern corner of Northampton County at the Delaware Water Gap. This area provides picnicking, hiking, hunting, fishing, and sight seeing. A state park of about 500 acres is being established north of Nazareth in Bushkill Township. It is known as Jacobsburg State Park and will provide hiking, picknicking, and limited fishing in a small lake on the Bushkill Creek.

Easton, located at the confluence of the Lehigh and Delaware Rivers, was established by William Penn's descendants as the county seat of Northampton County. The rapid growth of Easton and Allentown and Bethlehem to the west has almost linked the three communities as one city. Early settlers in the county were of different national backgrounds. Persons of German descent were more numerous, and this German heritage is still evident.

Population density is greatest in the limestone area of the broad central valley because, during an early agricultural period, urban communities grew in the farming area to service the growing farm population. The rivers played an important role in the county's early history by providing transportation to the Philadelphia area.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Northampton County, where they are located, and how they can be used. The soil scientists went into the

county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in countries nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Most soil series are named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Berks and Wurtsboro, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Berks shaly silt loam, 0 to 3 percent slopes, is one of several phases within the Berks series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit, the undifferentiated group, is shown on the soil map of Northampton County.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Berks and Weikert soils, 25 to 65 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Stony land is a land type in Northampton County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Northampton County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

Nine soil associations are recognized in Northampton County, and they are placed in four general groups, mainly according to texture.

Associations 1, 2, and 3, which together occupy about 16 percent of the county, are made up of soils and land types that have an extremely stony or gravelly surface layer and firm, cobbly and gravelly subsoil. These three associations are on and along the base of Blue Mountain, in the northern part of the county, and on galciated uplands in the northeastern part. Most of the extremely stony areas are wooded, but in some areas the stones have been piled in fence rows, and crops are grown. Most of the nonstony areas are in crops or pasture.

Associations 4 and 5, which together occupy about 38 percent of the county, are made up of soils that have a shaly or channery surface layer and a shaly subsoil. These two associations form a wide band across the glaciated uplands

in the northern half of the county. Most areas are cleared and cultivated; the steeper parts are in pasture or woodland.

Associations 6, 7, and 8, which occupy about 40 percent of the county, are made up of soils that have a medium-textured surface layer and a medium-textured or moderately fine textured subsoil. These three associations are dominant in the central limestone valley and in the hilly, unglaciated areas in the southern part of the county. Most areas in the limestone valley have been cleared and cultivated. Many of the steeper areas in the southern part of the county are in pasture or woodland; many of the less steep areas are cultivated.

Association 9, which occupies about 6 percent of the county, is made up of soils that have a medium-textured to moderately coarse textured surface layer and subsoil. This association occupies stream terraces and flood plains in many parts of the county and also moraines,kames, and eskers in the northeastern part. Most of the acreage on terraces and flood plains is cultivated. The other areas are mainly in pasture or woodland, but some well-drained sites are cultivated.

Descriptions of the nine associations follow. Where the term for texture is indicated in the descriptive legend of an association it refers to the surface layer of the soils. Most of the names and some of the boundaries in the Northampton County general soil map do not match those in earlier surveys (i.e., those for Lehigh and Carbon Counties) because of changes in the concept of some series, differing soil patterns in adjacent areas, and correlations which have combined some soils into other associations.

1. Laidig-Stony Land Association

Gently sloping to very steep, deep, well-drained, extremely stony soils and land types on upper mountain slopes

This association (fig. 2) is confined to a rather narrow band extending across the entire northern boundary of the

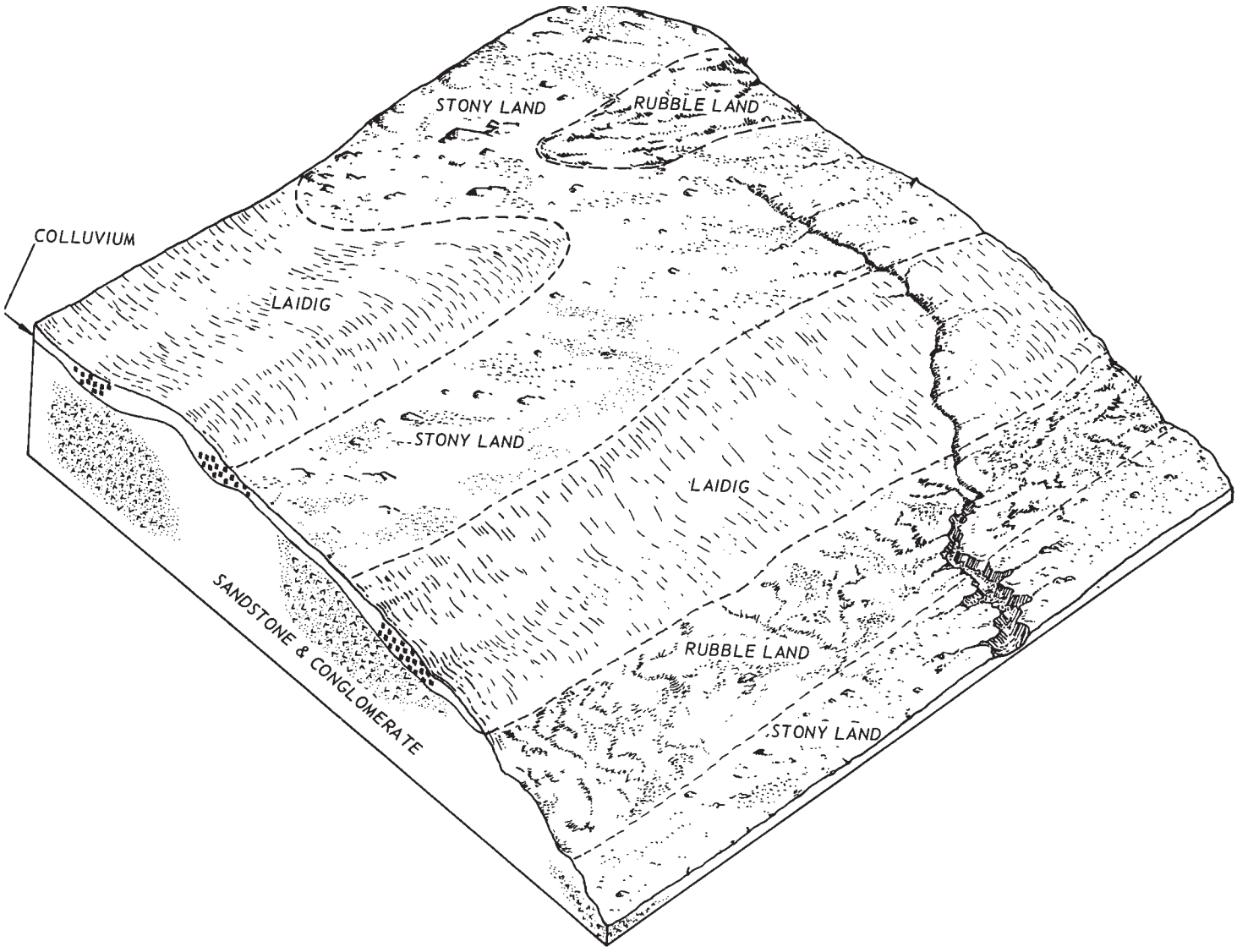

Figure 2.—Typical pattern of soils and underlying material in association 1.

county. The band on Blue Mountain is interrupted for a short distance west of Route 191 at Fox Gap, but it continues east to the Delaware Water Gap. Wet spots occur at random throughout the association. This association makes up about 3 percent of the county.

The deep, well-drained Laidig soils make up about 33 percent of this association, and Stony land about 32 percent. Less extensive soils, principally of the Buchanan and Andover series and of Rubble land, make up the remaining 35 percent.

All of the soils of this association are too stony for cultivation, though some small areas on the mountain top are suitable for clearing and for use as wildlife flood plots. Most of the State-owned game lands in the county are in this association. Stoniness and steepness of slope are limitations to use of these soils as building sites for other purposes related to town and country planning.

2. Buchanan-Laidig-Andover Association

Gently sloping to moderately steep, deep, well-drained to poorly drained soils on mountain foot slopes

This association (fig. 3) is confined to a rather narrow, irregularly shaped band extending across the county near the northern boundary. This band is discontinuous near the eastern boundary. The association is randomly dissected by many small drainageways and is in narrow bands along drainageways adjacent to the larger streams. This association makes up about 5 percent of the county.

All of the acreage was originally extremely stony. On some of the better drained areas, the stones have been removed to fence rows, and the soils are cultivated in small fields. Other areas are cleared and are in pasture. Soils that have impeded drainage or excess water are on the lower slopes and in drainageways. Seeps and springs are common on the lower part of the mountain foot slopes.

The deep, moderately well drained and somewhat poorly drained Buchanan soils make up about 28 percent of this association; the deep, well-drained Laidig soils about 25 percent; and the poorly drained Andover soils about 20 percent. The remaining 27 percent is made up of Stony land and less extensive soils, principally of the Bedington and Comly series.

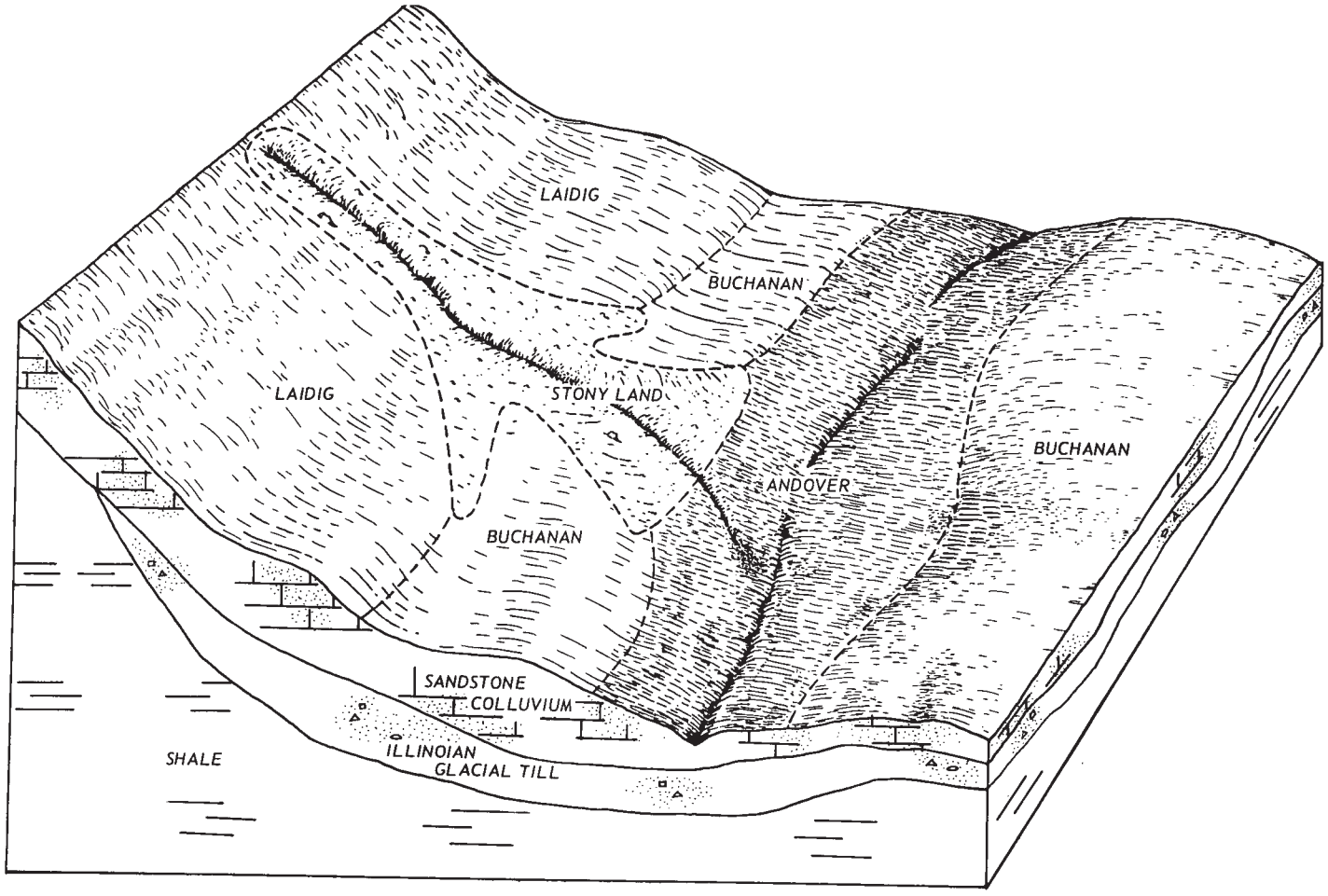

Figure 3.—Typical pattern of soils and underlying material in association 2.

Most of this association is either too wet or too stony to be cultivated. Most of the acreage is wooded or idle. Small areas are cultivated and used for cash crops, or they are for beef cattle pasture. Stoniness, restricted permeability, and a seasonal high water table limit the use of these soils as building sites or for other purposes related to town and country planning. Pond sites are common on the lower slopes, and they are suitable for water-based recreation.

3. Swartswood-Wurtsboro-Chippewa Association

Gently sloping to moderately steep, deep, well-drained to poorly drained soils on glaciated uplands

This association (fig. 4) is in the extreme northeastern part of the county in Washington, Upper Mount Bethel, and Lower Mount Bethel Townships. Its southwestern boundary nearly coincides with the lower limit of the Wisconsin glaciation. This association consists of soils on low, rounded hills and irregular, convex slopes, In some areas these soils are hummocky. This association makes up about 8 percent of the county.

Most of this association was originally stony to extremely stony. On the better drained areas, the stones have been removed to fence rows (fig. 5), and the soils are cultivated in small fields. Where stones are too numerous to be removed, the soils are cleared for pasture or left wooded. Some areas that were formerly cultivated by horse-drawn equipment have reverted to trees because use of farm machinery is difficult. Soils that have impeded drainage or excess water are throughout the association. In potholes and drainageways the soils are almost all poorly drained. Seeps and springs are common.

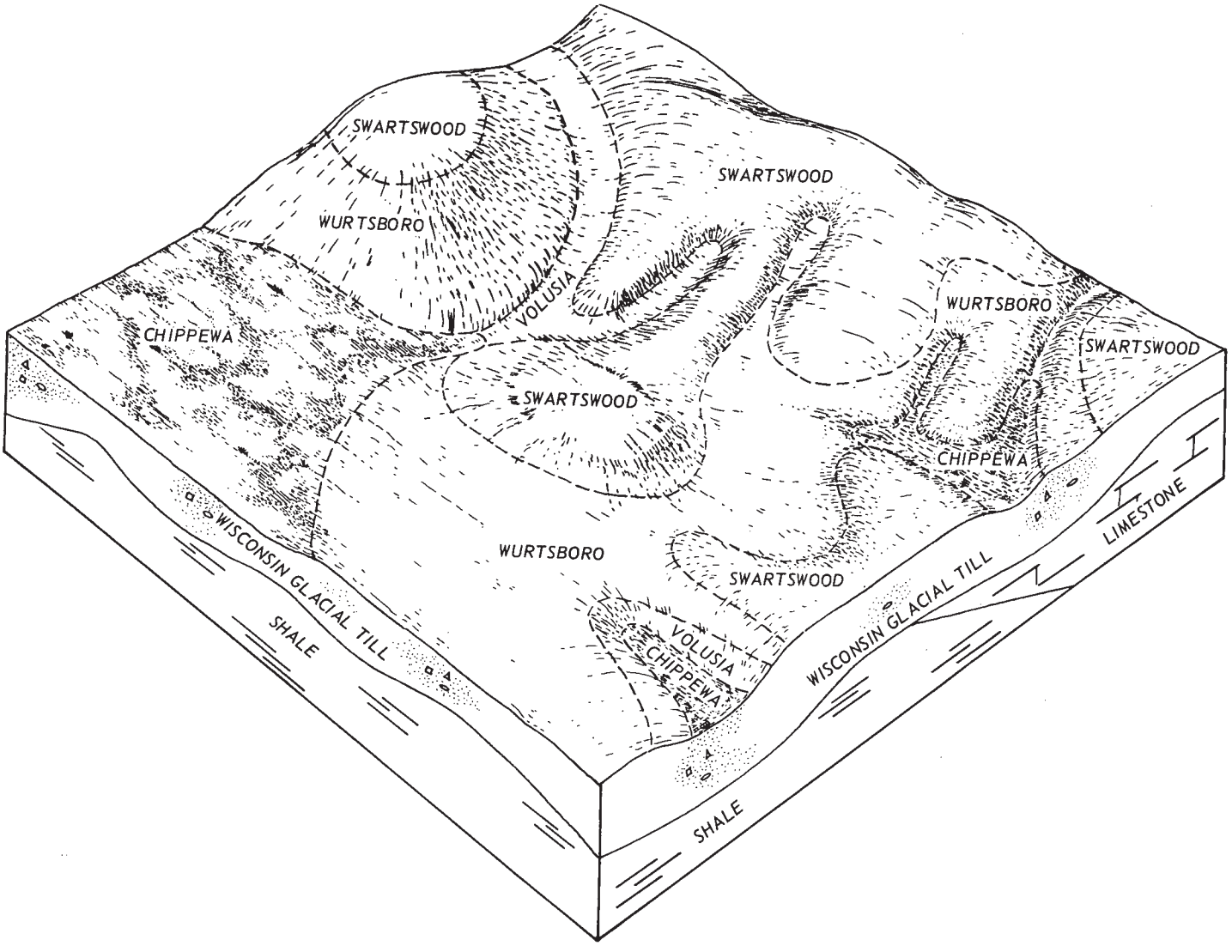

Figure 4.—Typical pattern of soils and underlying material in association 3.

Figure 5.—Stones piled in a fence row in association 3 north of Johnsonville. The largest stones are 5 feet in diameter.

The deep, well-drained Swartswoods soils make up about 38 percent of this association; deep, moderately well drained Wurtsboro soils about 27 percent; and poorly drained Chippewa soils about 16 percent. Volusia, Buchanan, and other less extensive soils make up the remaining 19 percent.

Dairying is the principal type of farming in this association. The many stones, uneven drainage pattern, and the high cost of land make the area generally not suited to large-scale farming. The largest orchards in the county, however, are in this association. Nearness of this association to the Delaware Water Gap National Recreation Area and to Interstate Highway No. 80, which links this area with New York City, has significantly raised land values. Because of these factors, the pattern of land ownership is shifting from family-owned farms to absentee-owned farms or leased farms. Also, many areas that were formerly farmed are idle. Some commercial recreation projects have been established. A large percentage of this association has been left wooded because of the stoniness and poor drainage of the soils. Areas near small towns and along main roads are used increasingly as building sites and for other purposes related to town and country planning. Restricted permeability and a seasonal high water table (fig. 6) are major limitations to use of the soils in this association. Water for livestock and household use generally is available in sufficient quantities from springs, ponds, and wells. In general, water-bearing strata are at a depth of less than 200 feet (*15*).[1]

[1]Italic numbers in parentheses refer to Literature Cited, page 118.

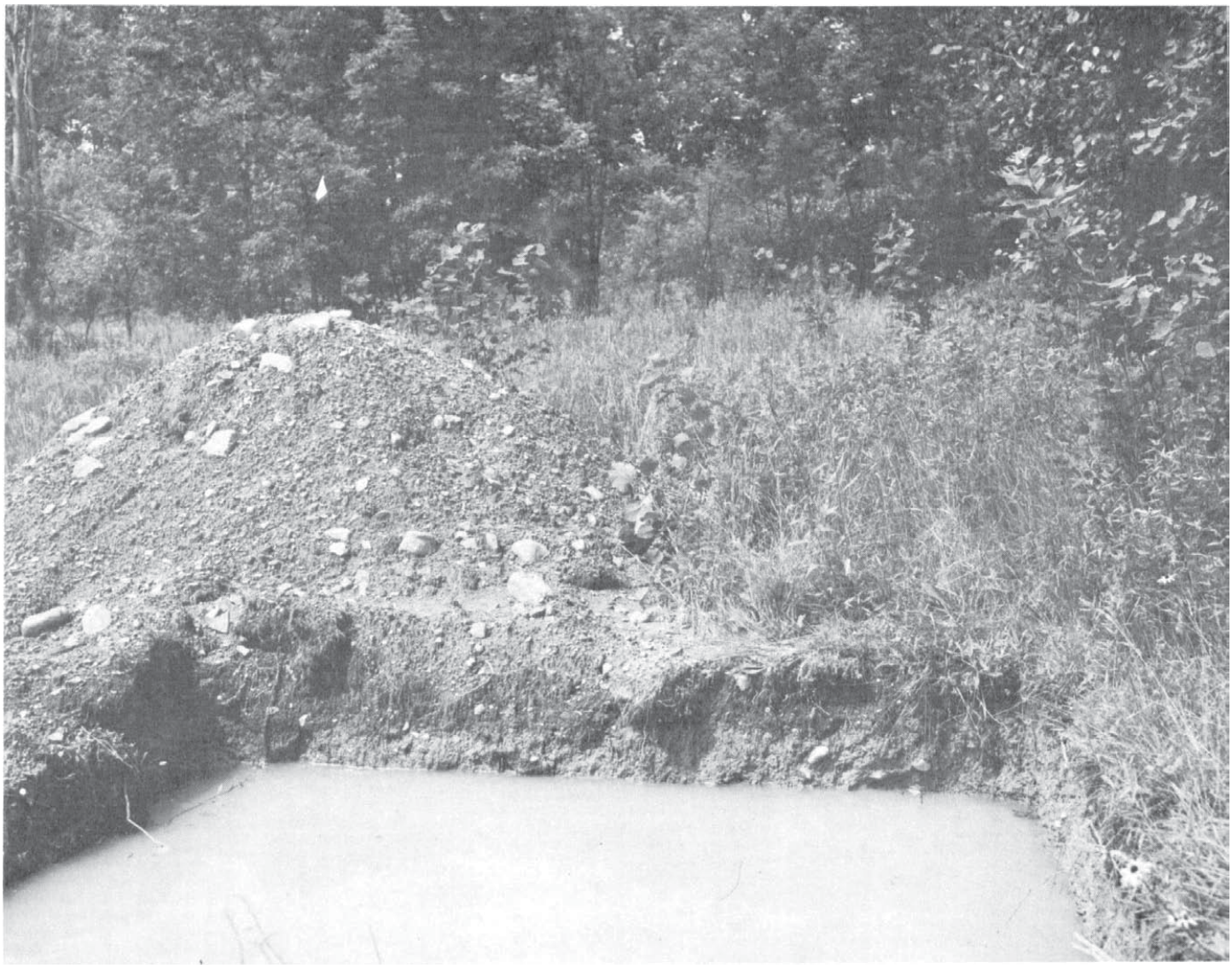

Figure 6.—Seasonal high water table typical of soils in association 3.

4. Berks-Bedington-Comly Association

Gently sloping to steep, moderately deep and deep, well-drained to somewhat poorly drained soils underlain by acid, gray shale

This association (fig. 7) forms a wide band across the northern half of the county, terminating at the lower limit of the Wisconsin glaciation. Isolated areas occur within the northeastern part of the county, but they are quite small. This association has prominent, rounded hills and ridges in the southern half and is gently rolling and relatively smooth in the northern half. Slopes are generally convex, and the areas are randomly dissected by small drainageways. This association makes up 33 percent of the county.

Most of this association consists of moderate to large cultivated fields. The steepest areas are cleared for pasture or left wooded. Soils that have impeded drainage or excess water are almost exclusively in drainageways, along streams, and on lower foot slopes of hills and ridges. Springs and seeps are at the head of most drainageways.

The moderately deep, well-drained Berks soils make up about 52 percent of this association; the deep, well-drained Bedington soils about 18 percent; and the moderately well drained and somewhat poorly drained Comly soils 12 percent. Less extensive soils, principally of the Brinkerton and Wikert series, make up the remaining 18 percent.

This association is used mainly for dairy farming, but some areas are farmed for cash crops and potatoes. Other areas are used for orchards and truck crop farms. Abandoned slate quarries that dot the countryside have little or no economic value. The stable, family-type farm is more common in this association than in any other associatin in the county. Areas near small towns and along the main highways are used increasingly as sites for buildings and for other purposes related to town and country planning. Steepness of slope, impeded drainage, and shallowness to

bedrock are the major limitations to nonfarm use. Water for livestock and household use generally is available in sufficient quantities from springs and wells. In general, water-bearing strata are at a depth of less than 200 feet (*15*).

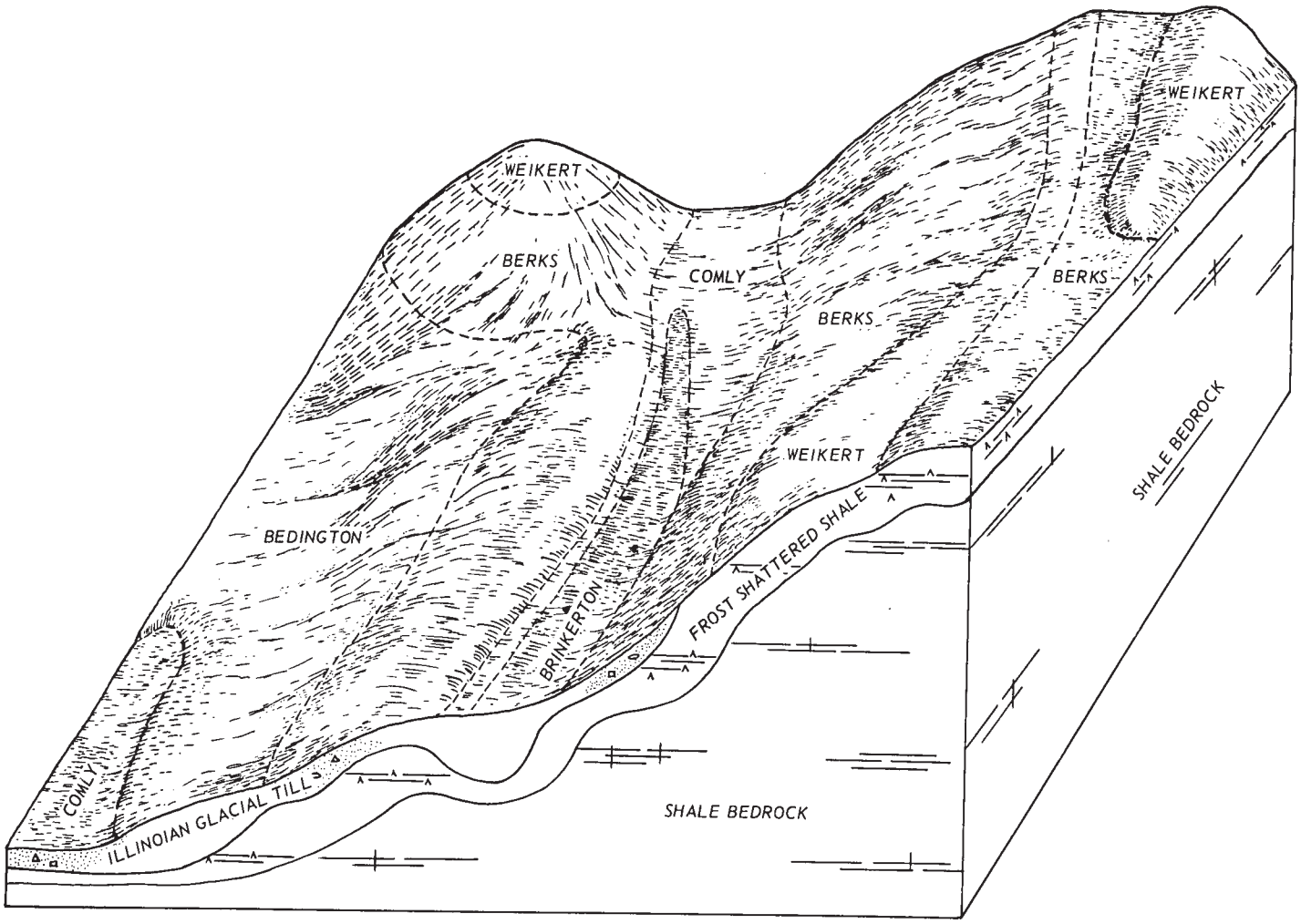

Figure 7.—Typical pattern of soils and underlying material in association 4.

5. Berks-Weikert Association

Gently sloping to very steep, shallow and moderately deep, well-drained soils underlain by acid, gray shale

This association is confined to the southeastern part of Upper Mount Bethel and Washington Townships and the northern part of Lower Mount Bethel Township. Its southern boundary nearly coincides with the southern limit of the Wisconsin glaciation. The association consists of soils on prominent, rounded hills or ridges and smooth, convex slopes. This association makes up about 5 percent of the county.

Most of the soils in this association were originally cobbly and channery, but in many gently sloping to steep soils the cobblestones and larger channery fragments have been removed to fence rows, and these soils are cultivated in moderate-size fields. The steeper areas are cleared for pasture or left wooded. Many of the moderately steep and steep soils that were formerly cultivated have reverted to trees or are idle. The less extensive soils of this association that have impeded drainage or excess water are in drainageways, along streams, and on lower foot slopes of the hills and ridges.

The moderately deep Berks soils make up about 55 percent of this association and the shallow Weikert soils about 20 percent. Less extensive soils, principally of the Wurtsboro, Chippewa, and Volusia series, make up the remaining 25 percent.

Dairying is the principal type of farming in this association. Because of steepness of slope, the many stones, and the high cost of land, the area is not well suited to large-scale farming. Nearness of this association to the Delaware Water Gap National Recreation Area and to Interstate Highway 80, which links this area with New York City, has significantly raised land values and influenced land use. The

number of family-owned farms is declining, and absentee-owned farms, leased farms, and idle land are increasing. Areas along main roads are used increasingly as building sites. The shallowness and steepness of slope are limitations to nonfarm uses. In much of the association, contamination of ground and surface water is a hazard if onsite sewage disposal systems are used. Water for livestock and household use is available in limited quantities from wells and springs. In general, water-bearing strata are at a depth of less than 300 feet (*15*).

6. Duffield-Clarksburg-Ryder Association

Nearly level to sloping, deep and moderately deep, well-drained and moderately well drained silty soils underlain by shaly limestone

This association is confined to a narrow band across the central part of the county. It extends from Northampton on the west to Riverton on the east. The eastern third of this band is discontinuous. The association consists of soils on smooth, long, uniform slopes. Drainageways are widely spaced and not distinctly developed. This association makes up about 5 percent of the county.

All of this association has been cleared and is farmed in large fields. Large areas have been strip mined for cement rock. Cement rock is a major income-producing resource for the county The less extensive soils in this association that have impeded drainage are only in drainageways, along streams, and on the lower end of long slopes. Springs and seeps are not common.

The deep, well-drained Duffield soils make up about 25 percent of this association; the deep, moderately well drained Clarksburg soils about 20 percent, and the moderately deep, well-drained Ryder soils 16 percent. Comly and other less extensive soils and Urban land make up the remaining 39 percent.

Dairying and growing cash crops are the principal types of farming in this association. Large-scale, family farming is common. Corporate farming enterprises own and lease a significant percentage of this association. As much as 40 percent of some townships is industrially owned. Many small housing developments have been established from Martins Creek to Nazareth and west to Northampton. The greatest concentration is adjacent to towns where city water is available. The soils of this association have varying degrees of limitations to use as building sites. Water for livestock and household use is generally available in sufficient quantities from wells. The depth to water bearing strata varies, and the quantity and quality of the water are generally undependable. Ground-water contamination is a serious hazard on most of these soils if they are used for onsite sewage disposal.

7. Washington-Urban Land Association

Nearly level to sloping, deep, well-drained soils and land types underlain by thin glacial till over cavernous limestone

This association forms a wide band across the central part of the county, extending from Northampton and Bethlehem on the west to Sandts Eddy and South Easton on the east. Large areas also occur in Saucon Valley, Stouts Valley, between Delhaven and Foul Rift, and south of Wassergass. The association is undulating and rolling and has many closed depressions. Most drainageways are widely spaced and not distinctly cut. Along major streams, however, are small areas of steep and very steep bluffs. These bluffs are particularly evident near Easton where the Lehigh River and Bushkill Creek join the Delaware River. This association makes up about 25 percent of the county.

Most of this association is cleared and farmed in large fields. The small steep and very steep areas are wooded. Significant acreage is strip mined for limestone and iron ore. Limestone and iron ore are major income-producing resources for the county. The less extensive soils that have impeded drainage are in drainageways, along streams, and on the lower end of long slopes. Springs and seeps are rare.

The deep, well-drained Washington soils make up about 66 percent of this association, and Urban land, which includes the cities of Bethlehem and Easton, about 20 percent. Less extensive soils, principally of the Clarksburg series, make up the remaining 14 percent.

Dairying and growing cash crops are the principal types of farming in this association. Large-scale, family farming is common. Corporate farming enterprises own and lease a significant percentage of this association. Eventually all of this association between Bethlehem and Easton will likely be Urban land. Water and sewer lines have been extended, and a major network of limited access highways is under construction. The soils in this area have varying degrees of limitations to use as building sites (fig. 8). Water for livestock and household use, in addition to that from water mains, generally is available in sufficient quantities from wells and cisterns. Depth to water-bearing strata varies, and the quantity, and quality of the water are generally undependable. Ground-water contamination is a severe hazard.

8. Conestoga-Hollinger Association

Gently sloping to steep, deep, well-drained soils underlain by granite, schist, gneiss, and quartzite

This association is mainly in the southern part of the county, but two small areas, isolated from the main part of the association, are north of the Lehigh River. The largest of these areas is the College Hill section of the city of Easton, which is on a high ridge of Conestoga and Hollinger soils. The other area is on a similar ridge known as Camel's Hump, which is 3 miles north of Bethlehem and parallel to Route 22. This association consists of soils on prominent, rounded hills or ridges and irregular, convex slopes. This association makes up about 10 percent of the county.

Most of this association was originally stony to extremely stony. On the more level upland areas the stones have been removed to fence rows and the soils are cultivated in small fields. Where stones are too numerous to be removed, the soils are cleared for pasture (fig. 9) or left wooded. Some cleared areas that were formerly cultivated by horse-drawn equipment have now reverted to trees because use of machinery is difficult. Soils that have impeded drainage or excess water are in drainageways, along streams, and on the lower foot slopes of hills and ridges.

The deep, well-drained Conestoga soils make up about 40 percent of this association, and the deep, well-drained Hollinger soils make up about 36 percent. The Baile and Urbana soils; various soils on flood plains; Urban land; and a deep, red, gravelly soil mapped with Conestoga and Hollinger soils make up the remaining 24 percent. The red soils are in the extreme southern part of the Lower Saucon Township.

This association has some of the better soils of the county for farming. Because of the many stones and the uneven re-

Figure 8.—Washington very rocky silt loam, 25 to 75 percent slopes. This soil has severe limitations to most uses.

lief, the areas are generally not suited to large-scale farming. A few orchards are in this association. Most of this association is owned by part-time farmers who work in diversified industries between Bethlehem and Easton. Part of this association is in small homesteads of 10 to 25 acres or more. The soils have varying degrees of limitations to use as building sites (fig. 10). Water for livestock and household use is generally available in sufficient quantities from springs and wells; however, sand and mud flows have hindered well-drilling operations in some places. This association generally has fewer water-bearing strata than other associations in the county.

9. Conotton-Red Hook-Urban Land Association

Nearly level to moderately steep, deep, well-drained to somewhat poorly drained soils and land types underlain by sand and gravel on terminal moraines, kames, eskers, outwash terraces, and flood plains

The largest area of this association is in a kame and esker deposit between East Bangor and Portland. Part of this association occurs as bands along the streams of the county, especially along the Lehigh and Delaware Rivers. Other areas are southeast of North Bangor and between West Bangor and Factoryville. This association has two distinct kinds of relief: first, nearly level and benched on the outwash terraces and flood plains, and second, hummocky or karst on the moraines, kames, and eskers. This association makes up about 6 percent of the county.

On the moraines, kames, and eskers, the soils were originally stony to extremely stony. On the better drained areas, stones have been removed to fence rows, and the soils are cultivated in small fields. Where stones are too numerous to be removed, the soils are cleared for pasture or left wooded. Other areas, particularly on outwash terraces and flood plains, that are free of stones have been cleared, and the well-drained soils are farmed intensively. Soils that have impeded drainage are throughout the association. In potholes, marshes, and swamps the areas are commonly as large as 20 acres in size.

Figure 9.—Extremely stony Conestoga soils used as unimproved pasture. Stones are too numerous to be removed.

The deep, well-drained Conotton soils make up 40 percent of this association; the somewhat poorly drained Red Hook soils about 9 percent; and Urban land 6 percent. Barbour, Middlebury, Swartswood, Wurtsboro, and other less extensive soils make up the remaining 45 percent.

Dairying is the principal type of farming in this association, but some areas are farmed for cash crops, and other areas are used for truck crops, greenhouses, and orchards. Pressures to convert this association to nonfarm uses are high. Nearness to water makes this association ideal for recreational areas or as sites for summer homes. Most of this association is owned by absentee owners or part-time farmers. Some of it is in small units of 10 to more than 25 acres in size. Areas near small towns and along the main roads are used increasingly as building sites and for other purposes related to town and country planning. Stones and a high water table are limitations to most nonfarm uses. In most of the dominant soils, contamination of ground and surface water is a hazard if onsite sewage disposal systems are used. Water for livestock and household use is generally available in sufficient quantities from springs, wells, and ponds. This area generally has water-bearing strata at a relatively shallow depth; however, the quality of the water varies.

Use and Management of the Soils

This section begins with an explanation of the use and management of the soils in Northampton County for field crops. This is followed by a discussion of the use and management of the soils as woodland; then by a discussion of the relative suitability of the soils for management as wildlife habitat. The next part of the section concerns soils in connection with engineering; it consists mainly of tables that give descriptions of soil properties significant in engineering and interpretations of these properties as they affect the suitability of the soils for specified engineering uses. Lastly, soil properties that are significant in planning recreation facilities and other aspects of town and country development are described.

Use of the Soils for Crops

The system of capability grouping used by the Soil Conservation Service to classify soils according to their relative

Figure 10.—Area of Baile silt loam, neutral variant. High water table and slow permeability are limitations to most uses.

suitability for general field crops is explained in this part of the survey. Following this explanation are discussions of the use and management of the soils of Northampton County, as grouped according to this system. Next is a table that shows the relative productivity of the soils for the principal crops grown in the county.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (There are no class V soils in Northampton County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small leter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol; for example, IIe-4 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units[2]

The capability units in Northampton County are described in the following pages. The soils in any one unit are similar in the kind of management they require and in their response to that management.

Certain practices basic to good soil management are mentioned before the individual capability units are described. Fundamental are the selection of a suitable cropping system and the application of conservation practices that will supplement this system in maintaining productivity and in controlling wetness or erosion. The practices to be applied depend on the nature of the soil and the intensity of the cropping system used.

Among the practices that can be applied to conserve moisture and to control erosion on sloping soils are contour stripcropping, terracing, and establishing sod in waterways. If the sloping soils are also wet, it is advisable to plant crops in graded strips; excess surface water can be removed by terraces and sod waterways, and excess subsurface water through random tile lines and open ditches, provided there are suitable outlets. Growing winter cover crops and greenmanure crops, managing crop residue, and keeping tillage to the minimum are among the measures that help to maintain or increase the organic-matter content, maintain or improve soil structure, and reduce the erosion hazard. Such practices are especially needed if the cropping system is intensive or cultivation is continuous.

Line and fertilizer should be applied according to soil tests and the needs of the crops.

Additional help in managing the soils can be obtained by consulting the local representatives of the Soil Conservation Service, the County Extension Service, or members of the staff of the State Agricultural Experiment Station.

The names of the soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series are in the unit. To find the capability classification of any given soil, refer to the "Guide to Mapping Units" at the back of this publication.

CAPABILITY UNIT I-1

This unit consists of nearly level, deep, well-drained soils of the Bedington, Duffield, and Washington series. These soils are on uplands. The Duffield and Washington soils are more undulating and less stony than Bedington soils.

These soils are easy to till. Permeability is moderate, and available water capacity is moderate to high. The erosion hazard is slight.

These soils are well suited to all crops commonly grown in the county. Crops respond well to fertilizer and good management. Growing cover crops utilizing crop residue, and including hay in the cropping system are ways of maintaining the organic-matter content and good tilth.

CAPABILITY UNIT IIe-1

This unit consists of gently sloping to sloping, deep, moderately well drained and somewhat poorly drained soils of the Buchanan, Clarksburg, Comly, Phelps, thick solum variant, and Urbana series. These soils are on uplands. They generally occupy drainageways, depressions, and lower foot slopes along the base of ridges and mountains.

Available moisture capacity is moderate to high. Permeability is moderately slow to slow. The erosion hazard is moderate.

If these soils are protected from erosion, they are suited to all crops and pasture grasses commonly grown in the county. Graded strips, diversions, and sod waterways help to control erosion. Because these soils are somewhat wet, alfalfa in long stands tends to winterkill. Winter grains are often affected by frost heaving. Tile can be used to drain seeps to permit cultivation earlier in spring.

CAPABILITY UNIT IIe-2

This unit consists of gently sloping, deep, well-drained soils of the Bedington, Conestoga, Duffield, Hollinger, and Washington series. These soils are on uplands.

These soils are east to till. They have moderate permeability and moderate to high available moisture capacity. Runoff is medium to slow. The erosion hazard is moderate.

[2] Prepared in cooperation with ROBERT L. BOND, conservation agronomist, Soil Conservation Service.

Figure 11.—Conestoga silt loam, 2 to 8 percent slopes, in capability unit IIe-2. Stripcropping helps to control erosion.

These soils are suited to all crops commonly grown in the county. Stripcropping (fig. 11), contour cultivation, sod waterways, and diversions can be used to help control erosion.

CAPABILITY UNIT IIe-3

This unit consists of nearly level to gently sloping, moderately deep, well-drained soils of the Berks and Ryder series.

These soils are easily worked, and tillage early in spring is possible. Available moisture capacity is moderate to low. Permeability is moderate to moderately rapid. The erosion hazard is moderate.

These soils are suited to all crops commonly grown in the county. They are well suited to alfalfa and other deep-rooted crops that withstand droughtiness. Stripcropping (fig. 12), cover crops, terraces, and diversions can be used to help control erosion and to conserve moisture. A good sod in drainageways prevents scouring.

CAPABILITY UNIT IIw-1

This unit consists of nearly level, deep, well-drained to somewhat poorly drained soils of the Barbour and Middlebury series. These soils are on flood plains, and are subject to flooding. Flooding is of short duration and generally does not occur during the growing season.

Middlebury soils have a seasonal high water table late in winter and early in spring. Available moisture capacity is moderate in these soils, and permeability is moderate to moderately rapid.

If the wetter areas are drained, these soils can be cropped year after year. Surface drainage, where needed, can be obtained by keeping natural drainageways open and providing outlets for the depressions. Where practical, digging ditches to lower the water level of the streams draining these soils aids in the location and installation of outlets for tile drains. Cover cropping can be used to help control erosion.

CAPABILITY UNIT IIw-2

This unit consists of nearly level to gently sloping, deep, moderately well drained to somewhat poorly drained soils of the Clarksburg, Comly, and Wurtsboro series.

These soils have low to high available moisture capacity and moderately slow to slow permeability. They warm slowly in spring. The areas in depressions and drainageways are covered by shallow water during heavy rains. Depth of the root zone is limited by a firm, brittle, fragipan in the lower part of the subsoil.

Figure 12.—Berks shaly silt loam, 3 to 8 percent slopes, in capability unit IIe-3. Contour stripcropping helps to control erosion.

If these soils are artificially drained, they are suited to all crops commonly grown in the county. Legumes and winter grain are often affected by frost heaving. Natural drainageways need to be kept open to provide outlets for water lying in depressions. Graded stripcropping, sod waterways, and diversion terraces can be used to help control erosion.

CAPABILITY UNIT IIs-1

This unit consists of nearly level and gently sloping, deep, well-drained soils of the Conotton and Swartswood series.

These soils have low available moisture capacity and moderate to moderately rapid permeability.

These soils are suited to most crops commonly grown in the county. During seasons of low rainfal, crops are likely to be damaged because of shortage of moisture. Tilling on the contour, growing cover crops, and utilizing crop residue are ways of increasing the organic-matter content, improving tilth, and conserving moisture.

CAPABILITY UNIT IIIe-1

This unit consists of sloping, deep, well-drained soils of the Bedington, Conestoga, Hollinger, and Washington series.

These soils are easy to till. Permeability is moderate, and available moisture capacity is moderate to high. The erosion hazard is high if these soils are cultivated.

If these soils are protected from erosion, they are suited to all crops commonly grown in the county. Contour strips (fig. 13) and diversions help to control further erosion. Growing cover crops and leaving crop residue on the surface increase the organic-matter content, protect the soil from excessive runoff, and help to control further erosion.

CAPABILITY UNIT IIIe-2

This unit consists of sloping, deep, well drained and moderately well drained soils of the Conotton, Swartswood, and Wurtsboro series.

These soils have low available moisture capacity, and moderately slow to rapid permeability. If these soils are cultivated and are not protected, the erosion hazard is high.

These soils are suited to most crops commonly grown in the county. Alfalfa grown on Wurtsboro soils is susceptible to winterkill.

Contour stripcropping, diversion terraces, and sod waterways can be used to help control erosion. Growing cover crops and leaving crop residue on the surface supply needed organic matter, conserve moisture, and reduce runoff, and help to control further erosion.

CAPABILITY UNIT IIIe-3

This unit consists of sloping, moderately deep, well-drained soils of the Berks and Ryder series.

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Figure 13.—Conestoga silt loam, 8 to 15 percent slopes, in capability unit IIIe-1. The countour strips help to control erosion.

These soils are easily worked, and tillage early in spring is possible. Permeability is moderate to moderately rapid, and available moisture capacity is moderate to low. Erosion and droughtiness are major hazards if these soils are cultivated.

If these soils are protected from erosion, they are suited to most crops commonly grown in the county. Strips and diversions help to control further erosion. However, bedrock can hinder the construction of diversions. Growing cover crops and leaving crop residue on the surface supply needed organic matter, conserve moisture, reduce runoff, and help to control further erosion.

CAPABILITY UNIT IIIe-4

Weikert channery silt loam, 3 to 8 percent slopes, is the only soil in this unit. This is a gently sloping, shallow, well-drained soil that has a thin channery surface layer and subsoil over fractured and frost-churned bedrock.

The root zone is restricted. The erosion hazard is high.

Low available moisture capacity and coarse texture severely limit the kinds of crops that can be grown on this soil.

Contour stripcropping and diversion terraces help to control further erosion. In places bedrock may hinder the establishment of a cover crop on diversions. Growing cover crops and leaving crop residue on the surface are ways of supplying organic matter, conserving moisture, reducing runoff, and helping to control further erosion.

CAPABILITY UNIT IIIw-1

This unit consists of nearly level and gently sloping, deep, somewhat poorly drained soils of the Red Hook and Volusia series.

Depth of the root zone is limited by a seasonal high water table. Excess water causes the soils to warm slowly in the spring.

If these soils are drained, they are suited to most crops commonly grown in the county. Legumes and winter grains grown on these soils tend to be winterkilled or to be heaved out by freezing.

Excess water can be drained from the surface by keeping natural drainageways open. Tile drains generally are not satisfactory in Volusia soils because the soils have a firm, brittle fragipan subsoil. In many places tile outlets are difficult to locate on Red Hook soils. In places graded strips, sod waterways, and diversion terraces are needed on the gently sloping soils to help reduce runoff and to control erosion.

CAPABILITY UNIT IVe-1

This unit consists of sloping to moderately steep, deep, well-drained soils of the Conestoga, Conotton, Hollinger, and Washington series. These soils have moderate to rapid permeability and low to high available moisture capacity. In places the Washington soils are severely eroded, and in other places rock outcrops hinder cultivation. The erosion hazard is very high if these soils are cultivated.

These soils are better suited to long-term hay or pasture than to crops. Contour strips, diversion terraces, and sod waterways can be used to help to reduce runoff and to control further erosion.

CAPABILITY UNIT IVe-2

This unit consists of moderately steep, moderately deep and deep, well-drained soils of the Berks and Swartswood series. These soils have moderate to moderately rapid permeability and low to moderate available moisture capacity. The erosion hazard is very high if these soils are cultivated.

These soils are better suited to long-term hay or pasture than to cultivated crops. If these soils are plowed for re-

planting hay or pasture grasses, contour strips, diversion terraces, and sod waterways help to reduce runoff and to control further erosion.

CAPABILITY UNIT IVe-3

Weikert channery silt loam, 8 to 15 percent slopes, is the only soil in this unit. This is a shallow, well-drained soil that has a thin channery surface layer and subsoil over fractured and frost-churned bedrock.

This soil has low available moisture capacity. The root zone is restricted. The erosion hazard is high if these soils are cultivated.

The kinds of crops that can be grown on this soil are limited. Vegetation that provides complete ground cover most of the year, stripcropping, and diversions can be used to help control further erosion. The bedrock is likely to hinder establishment of cover on diversions. Management practices that improve tilth and increase available moisture capacity are needed.

CAPABILITY UNIT IVw-1

This unit consists of nearly level, deep, poorly drained to very poorly drained soils of the Holly series and of Alluvial land, coal overwash.

Susceptibility to flooding and a high water table are the major limitations. Generally, flooding occurs in winter or spring, but in places flooding occurs in summer.

The coal washings on the surface of the Alluvial land, coal overwash, affect fertility and tilth, which are concerns in management.

If these soils are protected from flooding and artificially drained, they are suited to most crops commonly grown in the county.

Land forming and open ditches, where outlets are available, can be used to improve surface drainage where necessary. Management practices that improve tilth are needed.

CAPABILITY UNIT IVw-2

This unit consists of nearly level to sloping, deep, poorly to very poorly drained soils of the Andover, Brinkerton, Chippewa, and Halsey series.

These soils are adversely affected by runoff and seepage from adjacent slopes. They have slow to moderately slow permeability and moderate to low available moisture capacity. Depth of the root zone is limited by the high water table. The excess water severely limits these soils for cultivation. These soils warm very slowly in spring.

These soils are poorly suited to cultivated crops. They are suited to long-term hay or pasture, but they are better suited to hay that can tolerate wetness. Surface water can be removed by keeping the natural drainageways open and providing outlets to drain depressions. Surface water that flows from higher elevations should be diverted. Tile drains can be installed to drain seep spots.

CAPABILITY UNIT VIe-1

Weikert channery silt loam, 15 to 25 percent slopes, is the only soil in this unit. This is a shallow, well-drained, moderately steep soil that has a thin channery surface layer and subsoil over fractured and frost-churned bedrock.

The root zone is restricted, and the erosion hazard is very high. Available moisture capacity is low.

This soil is not suited to cultivated crops. It is suited to pasture and woodland. Areas of soils having south-facing slopes are extremely droughty. Yields of shallow-rooted pasture grasses are very low during the hot summer months. Drought-tolerant grasses or trees should be planted. Diversions and waterways can be used to help control further erosion.

CAPABILITY UNIT VIw-1

Baile silt loam, neutral variant, 2 to 8 percent slopes, is the only soil in this unit. This is a gently sloping, deep, poorly drained soil.

This soil has a high water table that limits the penetration of roots. Permeability is slow and available moisture capacity is high.

The high water table makes this soil unsuitable for cultivation and severely limits it for most other uses.

This soil is suited to seasonal pasture if grasses that tolerate wetness are grown. Keeping natural drainageways open and diverting surface water from higher elevations extend the growing season.

CAPABILITY UNIT VIIe-1

This unit consists of steep to very steep, shallow to deep, well-drained soils of the Berks, Conotton, and Weikert series (fig. 14).

These soils have moderately rapid to rapid permeability and low to moderate available moisture capacity. They have severe limitations for most uses, chiefly because of steepness of slope and the erosion hazard. These soils are too steep for crops, hay, or pasture. They can be used as woodland and as wildlife habitat.

CAPABILITY UNIT VIIw-1

Muck is the only soil in this unit. This organic soil is level and very poorly drained. It occupies depressions in the glaciated uplands. The water table is at or near the surface except in summer.

In most areas draining this soil artificially is costly. If this soil is drained, it is suitable for growing vegetables. If it is drained, however, the organic material shrinks, the surface becomes lower, and further drainage becomes more difficult. Before selecting an area of Muck for cultivation, individual areas should be studied to determine the possibility of reclamation. Muck can be used as a source of organic material. It has value as a natural reservoir for water.

CAPABILITY UNIT VIIs-1

This unit consists of nearly level to gently sloping, deep, somewhat poorly to poorly drained soils of the Andover, Baile, Chippewa, and Volusia series.

These extremely stony soils are mainly in drainageways and on the foot slopes of ridges and mountains. They have low to high available moisture capacity and slow permeability.

These soils are too stony and too wet for crops or pasture. They are fairly well suited to moisture-tolerant trees.

CAPABILITY UNIT VIIs-2

This unit consists of steep to very steep, deep, well-drained, extremely stony soils of the Conestoga, Hollinger, and Laidig series, and very rocky soils of the Washington series.

The stones, rocks, and boulders are from one to several feet in diameter. Permeability is moderate to moderately slow, and available moisture capacity is moderate to high.

Figure 14.—Typical area of Berks and Weikert soils, 25 to 65 percent slopes, used for Christmas tree production. Capability unit VIIe-1.

Because of stoniness and steepness of slope, these soils are better suited to woodland than to cultivated crops or pasture. In most areas, logging is difficult and hazardous, and replanting must be done by hand. Other areas are suitable for wildlife habitat development and for watershed.

CAPABILITY UNIT VIIs-3

This unit consists of nearly level to moderately steep, deep, somewhat poorly drained to well-drained, extremely stony soils of the Bedington, Buchanan, Conestoga, Comly, Hollinger, Laidig, Swartswood, and Wurstboro series (fig. 15).

These soils have high to low available moisture capacity and slow to moderate permeability. Stoniness makes these soils unsuitable for cultivation and severely limits them for most other uses.

CAPABILITY UNIT VIIIs-1

This unit consists of Stony land and Rubble land. These land types range from nearly level to very steep. They have a stony surface that has only a small amount of soil material between the stones. Although some areas of Stony land support a fairly good cover of timber, these land types are not suitable for growing trees for commercial purposes because they are difficult to manage. Most areas are suited to wildlife habitat and to watershed.

Productivity ratings

Table 1 shows the estimated productivity rating of each soil for representative field and specialty crops grown in the county and for pasture. It also shows the relative suitability of each soil for orchard crops. Each rating denotes the rela-

Figure 15.—Second growth of trees in an area of Buchanan extremely stony loam, 0 to 8 percent slopes, that is in cutover woodland. Capability unit VIIs-3.

tive productivity of the soil for the specified crop in relation to a standard index of 100. The standard index represents the average acre yield of the crop obtained on the most productive soils in the county under normal management. The average acre yield is given at the head of the appropriate column in table 1. The average acre yields are based on yields of crops during the favorable growing seasons while the soil survey was being made. The estimated ratings are averages for a 10-year period.

Productivity ratings are given for two levels of management. The ratings in columns A indicate yields to be expected under normal, or prevailing, management. The ratings in columns B indicate yields that may be obtained in average growing seasons under improved management. Improved management consists of planting adapted varieties of crops; applying fertilizer and lime in the amounts indicated by the results of soil tests; using currently recommended practices that control weeds, insects, and diseases; and using practices that help to control erosion and that safely remove excess surface water and excess water in the soils. Practices that help to control erosion include minimum tillage, contour tillage, stripcropping, good management of crop residue, drainage, and use of diversions and waterways. Other practices may be suggested by representatives of the Agricultural Extension Service and the Soil Conservation Service in this county. Irrigation was not considered in obtaining the ratings. The ratings in columns B are not intended to represent the maximum yields obtainable. Yields under this level of management vary for the different soils but generally represent an increase over present yields.

An index of 50 indicates that the soil is only about half as productive for the specified crop as a soil that has an index

TABLE 1.—*Estimated productivity ratings for field crops.*

[Productivity ratings in columns A refer to yields under normal, or prevailing, management. Ratings in columns B specified crop at the specified

Soil	Corn		Oats		Wheat		Barley		Hay	
	Grain (100=95 bu. per acre)		(100=70 bu. per acre)		(100=45 bu. per acre)		(100=60 bu. per acre)		Alfalfa-grass mixture (100=4.0 tons per acre)	
	A	B	A	B	A	B	A	B	A	B
Alluvial land, coal overwash	45	80	50	60	---	---	---	---	---	---
Andover gravelly loam, 0 to 3 percent slopes	45	95	55	95	---	---	---	---	---	---
Andover gravelly loam, 3 to 8 percent slopes	55	95	60	95	---	---	---	---	---	---
Andover extremely stony loam, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Baile silt loam, neutral variant, 2 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Baile extremely stony silt loam, neutral variant, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Barbour soils	100	125	100	115	90	100	100	115	85	115
Barbour and Middlebury soils, high bottom	75	115	95	115	85	100	95	110	75	115
Bedington silt loam, 0 to 3 percent slopes	85	125	100	115	90	110	90	110	75	115
Bedington shaly silt loam, 3 to 8 percent slopes	80	125	95	115	90	110	90	110	75	115
Bedington shaly silt loam, 8 to 15 percent slopes	70	115	85	105	80	100	85	100	70	105
Bedington extremely stony silt loam, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Berks shaly silt loam, 0 to 3 percent slopes	60	90	80	85	80	90	85	90	55	100
Berks shaly silt loam, 3 to 8 percent slopes	60	85	80	85	80	90	85	90	55	100
Berks shaly silt loam, 8 to 15 percent slopes	55	80	70	80	65	80	75	85	50	90
Berks shaly silt loam, 15 to 25 percent slopes	55	75	55	70	55	65	65	85	50	80
Berks and Weikert soils, 25 to 65 percent slopes	---	---	---	---	---	---	---	---	---	---
Brinkerton silt loam, 0 to 3 percent slopes	40	95	55	85	---	---	---	---	---	---
Brinkerton silt loam, 3 to 10 percent slopes	45	95	60	85	---	---	---	---	---	---
Buchanan gravelly loam, 3 to 8 percent slopes	65	110	80	95	80	90	75	90	55	90
Buchanan extremely stony loam, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Chippewa silt loam, 0 to 2 percent slopes	---	85	---	80	---	---	---	---	---	---

forage crops, and specialty crops, and suitability for orchards

refer to yields under improved management. Absence of data indicates that the soil is not suited to the level of management]

Hay—Continued		Pasture				Sweet corn		Potatoes		Suitability for orchards (apple, cherry, and peach)
Grass-legume mixture (100=2.7 tons per acre)		Bluegrass (100=100 cow-acre-days1/)		Tall grass (100=100 cow-acre-days1/)		(100=760 doz. ears per acre)		(100=500 bu. per acre)		
A	B	A	B	A	B	A	B	A	B	
75	130	80	125	---	150	---	---	---	---	
55	95	60	115	75	145	---	---	---	---	
60	95	65	115	80	145	---	---	---	---	
---	---	---	---	---	---	---	---	---	---	
35	80	---	---	50	100	---	---	---	---	
---	---	---	---	---	---	---	---	---	---	
80	130	90	160	150	255	85	125	90	130	
80	120	85	150	140	255	70	115	80	120	
85	125	90	150	150	255	85	125	100	135	Fair.
85	125	90	150	150	255	80	125	95	135	Good.
80	120	85	145	140	240	70	115	---	---	Good.
---	---	---	---	---	---	---	---	---	---	
60	110	65	135	105	230	60	90	80	110	Fair.
60	110	65	135	105	230	60	85	75	110	Fair.
55	95	60	115	100	200	55	80	---	---	Fair.
45	80	50	100	95	170	---	---	---	---	
---	---	---	---	---	---	---	---	---	---	
55	95	60	115	75	145	---	---	---	---	
60	95	65	115	80	145	---	---	---	---	
65	105	70	130	105	205	65	110	---	---	Fair.
---	---	55	110	---	---	---	---	---	---	
35	90	35	115	45	135	---	---	---	---	

TABLE 1.—*Estimated productivity ratings for field crops.*

Soil	Corn		Oats		Wheat		Barley		Hay	
	Grain (100=95 bu. per acre)		(100=70 bu. per acre)		(100=45 bu. per acre)		(100=60 bu. per acre)		Alfalfa-grass mixture (100=4.0 tons per acre)	
	A	B	A	B	A	B	A	B	A	B
Chippewa silt loam, 2 to 8 percent slopes	45	90	60	85	---	---	---	---	---	---
Chippewa extremely stony silt loam, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Clarksburg silt loam, 0 to 3 percent slopes	65	110	80	100	65	100	75	100	50	95
Clarksburg silt loam, 3 to 8 percent slopes	65	110	80	100	80	100	85	100	55	90
Comly silt loam, 0 to 3 percent slopes	60	105	70	95	65	90	65	90	50	90
Comly silt loam, 3 to 8 percent slopes	60	105	70	95	80	90	75	90	55	90
Comly extremely stony silt loam, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Conestoga silt loam, 2 to 8 percent slopes	80	130	95	115	90	110	90	110	70	120
Conestoga silt loam, 8 to 15 percent slopes	75	120	85	105	80	100	85	100	65	115
Conestoga silt loam, 15 to 25 percent slopes	70	115	80	100	80	90	85	100	60	110
Conestoga and Hollinger extremely stony silt loams, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Conestoga and Hollinger extremely stony silt loams, 8 to 25 percent slopes	---	---	---	---	---	---	---	---	---	---
Conestoga and Hollinger extremely stony silt loams, 25 to 65 percent slopes	---	---	---	---	---	---	---	---	---	---
Conotton gravelly silt loam, 0 to 3 percent slopes	70	115	70	115	90	100	90	110	70	115
Conotton gravelly silt loam, 3 to 8 percent slopes	70	110	85	115	80	100	85	110	65	100
Conotton gravelly silt loam, 8 to 15 percent slopes	65	95	80	100	80	90	85	100	60	100
Conotton gravelly silt loam, 15 to 25 percent slopes	60	90	70	70	65	80	75	90	60	95
Conotton gravelly silt loam, 25 to 65 percent slopes	---	---	---	---	---	---	---	---	---	---
Duffield silt loam, 0 to 3 percent slopes	85	130	100	115	100	110	90	110	70	120
Duffield silt loam, 3 to 8 percent slopes	80	130	95	115	90	110	85	110	65	115
Halsey silt loam	---	90	---	80	---	---	---	---	---	---
Hollinger gravelly silt loam 3 to 8 percent slopes	65	125	85	105	80	100	85	100	55	120
Hollinger gravelly silt loam, 8 to 15 percent slopes	60	115	80	100	65	90	75	90	50	105

forage crops, and specialty crops, and suitability for orchards—Continued

Hay—Continued		Pasture				Sweet corn		Potatoes		Suitability for orchards (apple, cherry, and peach)
Grass-legume mixture (100=2.7 tons per acre)		Bluegrass (100=100 cow-acre-days1/)		Tall grass (100=100 cow-acre-days/)		(100=760 doz. ears per acre)		(100=500 bu. per acre)		
A	B	A	B	A	B	A	B	A	B	
50	95	50	115	65	145	---	---	---	---	
---	---	---	---	---	---	---	---	---	---	
65	110	70	135	100	210	65	110	---	---	Poor.2/
65	110	70	135	105	205	65	110	---	---	Fair.2/
65	105	70	130	100	210	60	105	---	---	
65	105	70	130	120	205	60	105	---	---	
---	---	---	---	---	---	---	---	---	---	
80	120	85	150	135	275	80	130	90	130	Good.
75	120	80	145	125	255	75	120	---	---	Good.
70	115	75	140	120	245	---	---	---	---	Fair.
---	---	---	---	---	---	---	---	---	---	
---	---	---	---	---	---	---	---	---	---	
---	---	---	---	---	---	---	---	---	---	
75	130	80	160	140	255	70	115	80	115	Good.
75	120	80	150	100	230	70	115	80	115	Good.
70	115	75	140	95	225	65	95	---	---	Good.
65	110	70	135	90	210	---	---	---	---	Fair to poor.3/
---	---	---	---	---	---	---	---	---	---	
80	120	85	150	135	275	85	130	100	140	Excellent to good.4/
75	120	80	150	130	255	80	130	100	140	Excellent.
40	95	45	120	55	150	---	---	---	---	
65	120	70	145	110	275	65	125	85	125	Good.
55	115	60	140	100	240	60	115	---	---	Good.

TABLE 1.—*Estimated productivity ratings for field crops.*

Soil	Corn		Oats		Wheat		Barley		Hay	
	Grain (100=95 bu. per acre)		(100=70 bu. per acre)		(100=45 bu. per acre)		(100=60 bu. per acre)		Alfalfa-grass mixture (100=4.0 tons per acre)	
	A	B	A	B	A	B	A	B	A	B
Hollinger gravelly silt loam, 15 to 25 percent slopes	55	105	70	95	65	80	75	85	50	100
Holly silt loam	60	95	55	80	---	---	---	---	---	---
Laidig extremely stony silt loam, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Laidig extremely stony silt loam, 8 to 25 percent slopes	---	---	---	---	---	---	---	---	---	---
Laidig extremely stony silt loam, 25 to 65 percent slopes	---	---	---	---	---	---	---	---	---	---
Middlebury soils	100	125	95	115	85	100	95	115	75	115
Muck	---	---	---	---	---	---	---	---	---	---
Phelps gravelly silt loam, thick solum variant, 2 to 8 percent slopes	75	115	100	120	90	100	90	115	70	110
Red Hook gravelly silt loam	55	105	60	100	---	90	---	90	---	90
Rubble land	---	---	---	---	---	---	---	---	---	---
Ryder silt loam, 2 to 8 percent slopes	70	105	95	105	90	100	90	110	70	100
Ryder silt loam, 8 to 15 percent slopes	65	95	85	100	80	90	85	100	60	95
Stony land	---	---	---	---	---	---	---	---	---	---
Swartswood gravelly loam, 2 to 8 percent slopes	70	105	85	105	80	100	85	110	60	115
Swartswood gravelly loam, 8 to 15 percent slopes	60	95	80	100	80	90	85	100	60	110
Swartswood gravelly loam, 15 to 25 percent slopes	55	85	70	90	70	80	75	90	50	100
Swartswood and Wurtsboro extremely stony soils, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Swartswood and Wurtsboro extremely stony soils, 8 to 25 percent slopes	---	---	---	---	---	---	---	---	---	---
Urban land, nearly level Too variable to be rated.	---	---	---	---	---	---	---	---	---	---
Urban land, sloping Too variable to be rated.	---	---	---	---	---	---	---	---	---	---
Urban land, occasionally flooded Too variable to be rated.	---	---	---	---	---	---	---	---	---	---
Urbana silt loam, 2 to 10 percent slopes	65	105	80	100	80	100	75	100	55	90
Volusia gravelly silt loam, 2 to 8 percent slopes	45	85	60	95	---	---	---	---	---	---
Volusia extremely stony silt loam, 0 to 8 percent slopes	---	---	---	---	---	---	---	---	---	---
Washington silt loam, 0 to 3 percent slopes	90	130	100	115	100	120	100	125	100	140

forage crops, and specialty crops, and suitability for orchards—Continued

Hay—Continued		Pasture				Sweet Corn		Potatoes		Suitability for orchards (apple, cherry, and peach)
Grass-legume mixture (100=2.7 tons per acre)		Bluegrass (100=100 cow-acre-days1/)		Tall grass (100=100 cow-acre-days1/)		(100=760 doz. ears per acre)		(100=500 bu. per acre)		
A	B	A	B	A	B	A	B	A	B	
50	95	55	120	95	225	---	---	---	---	Fair.
75	130	90	135	---	170	---	---	---	---	
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---	---	---	---	---	---	---	---	---	---	
80	130	90	160	150	255	85	125	80	120	
---	---	---	---	---	---	---	---	---	---	
90	130	95	160	140	250	75	115	---	---	Fair.2/
65	110	70	135	90	200	55	105	---	---	Poor.2/
---	---	---	---	---	---	---	---	---	---	
75	110	80	135	135	230	70	105	80	110	Good to fair.5/
65	105	70	130	120	210	65	95	---	---	Good to fair.5/
---	---	---	---	---	---	---	---	---	---	
65	120	70	160	115	255	70	105	80	110	Good to fair.5/
65	110	70	150	115	245	60	95	---	---	Good to fair.5/
55	100	50	125	100	230	---	---	---	---	
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---	---	---	---	---	---	---	---	---	---	
65	105	70	130	105	205	65	105	---	---	Fair to poor.3/
60	110	65	135	80	170	---	---	---	---	
---	---	---	---	---	---	---	---	---	---	
95	150	100	160	160	320	90	130	100	140	Excellent to good.6/

TABLE 1.—*Estimated productivity ratings for field crops.*

Soil	Corn		Oats		Wheat		Barley		Hay	
	Grain (100=95 bu. per acre)		(100=70 bu. per acre)		(100=45 bu. per acre)		(100=60 bu. per acre)		Alfalfa-grass mixture (100=4.0 tons per acre)	
	A	B	A	B	A	B	A	B	A	B
Washington silt loam, 3 to 8 percent slopes	90	130	100	115	100	120	100	125	100	140
Washington silt loam, 8 to 15 percent slopes	85	125	95	105	90	110	90	115	95	135
Washington silt loam, 8 to 15 percent slopes, eroded	80	110	85	100	80	100	85	110	85	125
Washington silt loam, 15 to 25 percent slopes	80	115	85	105	90	125	85	110	90	130
Washington very rocky silt loam, 25 to 75 percent slopes	---	---	---	---	---	---	---	---	---	---
Weikert channery silt loam, 3 to 8 percent slopes	35	60	60	80	55	65	65	75	35	60
Weikert channery silt loam, 8 to 15 percent slopes	---	---	55	70	45	55	60	65	35	55
Weikert channery silt loam, 15 to 25 percent slopes	---	---	---	---	---	---	---	---	---	---
Wurtsboro gravelly silt loam, 2 to 8 percent slopes	65	95	80	100	65	90	75	100	55	90
Wurtsboro gravelly silt loam, 8 to 15 percent slopes	60	90	70	95	55	80	75	90	50	100

[1] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture can be grazed during a single grazing season without injury to the sod. An animal unit is one cow, one steer, one horse, or one mule; five sheep; or seven hogs. An acre of pasture that provides 30 days of grazing for 2 cows, for example has a carrying capacity of 60 cow-acre-days.

of 100. An index of more than 100 is possible. Berks shaly silt loam, 3 to 8 percent slopes (BrB), for example, has a rating under the A management level of 60 for corn grain, 80 for oats, 80 for wheat, 85 for barley, 55 for alfalfa-grass hay, 60 for grass-legume hay, 65 for bluegrass, 105 for tall grass, 60 for sweet corn, and 75 for potatoes. Consequently, under the prevailing level of management, one can expect yields of 55 bushels of corn per acre, 55 bushels of oats, 35 bushels of wheat, 50 bushels of barley, 2.1 tons of alfalfa-grass hay, 1.6 tons of grass-legume hay, 65 cow-acre-days for bluegrass pasture, 105 cow-acre-days for tall grass pasture, 440 dozen ears of sweet corn, and 375 bushels of potatoes.

Under improved management this same soil has a productivity rating of 85 for corn grain, 85 for oats, 90 for wheat, 90 for barley, 100 for alfalfa-grass hay, 110 for grass-legume hay, 135 for bluegrass, 230 for tall grass, 85 for sweet corn, and 110 for potatoes. This means that yields under improved management may equal 80 bushels of corn per acre, 60 bushels of oats, 40 bushels of wheat, 55 bushels of barley, 4.0 tons of alfalfa-grass hay, 3.0 tons of grass-legume hay, 135 cow-acre-days for bluegrass pasture, 230 cow-acre-days for tall grass pasture, 640 dozen ears of sweet corn, and 550 bushels of potatoes.

Use of the Soils as Woodland[3]

Northampton County has about 67,200 acres of woodland, of which 66,700 acres is classified commercial forest land. Farmers own 23 percent of the forest land; industry and private concerns own 71 percent; and the Pennsylvania Game Commission and the Pennsylvania Department of Forests and Waters own 6 percent.

Stands of second- and third-growth trees make up the woodland. The principal kinds of trees that make up the commercial forest land and the percentage of the total extent of each (*22*), as given by the U.S. Forest Service, are:

Virginia pine—pitch pine 1
Forests in which 50 percent or more of the stand is Virginia pine, pitch pine, or other yellow pines, singly or in combination.

Oak—hickory 71
Forests in which 50 percent or more of the stand is upland oak or hickory, singly or in combination. It also includes the yellow-poplar—oak forest type.

Elm—ash—red maple 13

[3] By V. C. MILES, woodland specialist, Soil Conservation Service.

forage crops, and specialty crops, and suitability for orchards—Continued

Hay—Continued		Pasture				Sweet corn		Potatoes		Suitability for orchards (apple, cherry, and peach)
Grass-legume mixture (100=2.7 tons per acre)		Bluegrass (100=100 cow-acre-days1/)		Tall grass (100=100 cow-acre-days1/)		(100=760 doz. ears per acre)		(100=500 bu. per acre)		
A	B	A	B	A	B	A	B	A	B	
95	150	100	160	160	320	90	130	100	140	Excellent to good.6/
80	140	90	160	160	310	85	125	---	---	Excellent to good.4/
75	120	80	150	155	285	---	---	---	---	Good to fair.5/
75	125	80	155	160	290	---	---	---	---	Good to fair.5/
---	---	---	---	---	---	---	---	---	---	
45	75	50	90	70	130	---	---	---	---	
40	70	45	85	65	125	---	---	---	---	
---	---	35	75	---	---	---	---	---	---	
65	115	70	135	105	230	65	95	---	---	Fair.2/
65	110	70	120	100	220	60	90	---	---	Fair.2/

2/Fair for apples; unsuitable for cherries and peaches.

3/Fair for apples; poor for cherries and peaches.

4/Excellent for apples; good for cherries and peaches.

5/Good for apples; fair for cherries and peaches.

6/Excellent for apples and peaches; good for cherries.

Forests in which 50 percent or more of the stand is American elm, black ash, or red maple, singly or in combination.

Maple—beech—birch 12
Forests in which 50 percent or more of the stand is sugar maple, beech, or yellow birch, singly or in combination.

Aspen—birch 3
Forest in which 50 percent or more of the stand is aspen, paper birch, gray birch, or pin cherry, singly or in combination.

Sawtimber grows on approximately 61 percent of the acreage in commercial forests, poletimber on 29 percent, and seedlings and saplings on 9 percent; the rest is classified nonstocked (*22*).

Trees grow well in this county, except in areas where soils are shallow or are very poorly drained. Many chestnut oak, scarlet oak, and red maple trees grow on soils that are also suited to red oak, yellow-poplar, ash, sugar maple, and white pine.

Landowners can encourage growth of desirable kinds of trees by using good woodland management. Help in planning a program of woodland improvement can be obtained from local foresters. The amount of effort that the landowner is willing to make toward improving his woodland probably depends on general economic conditions.

Studies have been made of the rate at which trees grow on two extensive soils in the county. The results of these studies are on file in the State Office of the Soil Conservation Service in Harrisburg, Pennsylvania. The trees studied grew on 16 sample plots. The oak (*18*) and yellow-poplar (*4*) indexes of site quality obtained for each of the soils was based on the average height attained by the tallest trees at the age of 50 years. Incorporated in these studies were results obtained in a like manner from surrounding counties.

Other soils in the county that have characteristics similar to those of the soils studied were assumed to have approximately the same rating. The volume of timber that an average stand will produce at different ages can be determined by the site quality ratings and applicable yield tables.

Information about the soils on which trees and associated plants are growing is basic for efficient management of woodland.

Of the commercial forest land, 37 percent consists of soils that provide excellent growing sites; 13 percent, soils that provide very good growing sites; 15 percent, soils that provide good growing sites; 11 percent, soils that provide fair growing sites; and 24 percent, soils that provide poor growing sites.

The returns from trees on soils that provide excellent, very good, and good growing sites generally justify the expenditure of money for management. Consideration should be given to the potential yield, the quality of the particular species growing on the site, and the market potential. The kinds of trees and the number of poor quality stems growing on these sites may prohibit the investment of money for management. The conversion of a poor stand from its present state to one that will yield at the potential capacity of the site may not be economically justifiable.

Soils that provide fair growing sites are the most difficult to appraise for forest management. A thorough appraisal of the trees as to species and quality is essential. The market possibilities should also be investigated. A proper analysis of these interrelated factors is essential to determine the intensity of forest management that is warranted.

The returns from soils that provide poor growing sites generally will not economically justify management for the production of wood products. The most practical use of such soils, however, is generally as woodland. Because of unfavorable soil characteristics, such soils generally will not show a profitable return if they are used for field crops or for pasture. Although returns may be slight or none at all if such soils are used as woodland, this use is the most practical.

Woodland in Northampton County is important because of its esthetic, recreational, and watershed uses. The principal beneficiaries of these uses are people from metropolitan and urban areas. These people are not likely to be interested in the respective merits of one forest species over another for saw logs or for fuel. They are likely to be interested in trees because trees provide comfort and beauty.

In table 2 interpretations are given for use of the soils as woodland. The table lists some of the hazards and limitations that affect woodland management on each soil. Species suitability and site quality are also listed for each soil. In the following paragraphs the information given in table 2 is discussed.

EROSION HAZARD.—The ratings for this hazard indicate the amount or intensity of practices required to reduce or control erosion in these areas. A rating of *slight* indicates that the risk of erosion is low when wood products are harvested, and that few if any practices are needed to control erosion. A rating of *moderate* indicates that erosion control measures are needed on skid trails and logging roads immediately after wood products are harvested. If the rating is *severe*, it means that erosion, especially gullying, is a severe hazard where wood products are harvested. Harvesting and other operations should be done across the slope wherever feasible. Skid trails and logging roads should be laid out on as low a grade as feasible, and systems for disposing of excess water should be carefully maintained during logging operations. Erosion-control measures are needed on logging roads and skid trails immediately after logging is completed.

EQUIPMENT LIMITATIONS.—Ratings in the column show the degree of equipment limitation based on the characteristics of the soils and topographic features that restrict or prohibit the use of equipment for harvesting trees or planting seedlings. Steepness of slope, stoniness, and wetness are the principal soil limitations that restrict the use of equipment. The rating is *slight* if there are few limitations. It is *moderate* if some limitations exist, such as stones and boulders, moderately steep slopes, or wetness during some part of the year. The rating is *severe* if prolonged wetness of the soil, steepness, or stoniness severely limit the use of equipment. If the rating is severe, track-type equipment is best for general use, and winches or similar special equipment may be needed.

SEEDLING MORTALITY.—Seedling mortality refers to the loss of naturally occurring or planted tree seedlings because of unfavorable characteristics of the soils. The rating is *slight* if no more than 25 percent of the planted seedlings are likely to die; satisfactory restocking from the initial planting can be expected; and adequate restocking generally results from natural regeneration. A rating of *moderate* indicates that between 25 and 50 percent of the planted seedlings are likely to die; that some replanting is generally needed; and that natural regeneration cannot always be relied upon for adequate and immediate restocking. A rating of *severe* indicates that more than 50 percent of planted seedlings are likely to die; that special preparation of the seedbed, superior planting techniques, and considerable replanting are needed for adequate and immediate restocking; and that restocking cannot be expected to result from natural regeneration.

PLANT COMPETITION.—Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade different kinds of soil. A rating of *slight* means unwanted plants will not prevent adequate natural regeneration and early growth or interfere with adequate development of planted seedlings. The rating is *moderate* if competing plants delay natural or artificial regeneration, the establishment of plants, and the rate of growth, but do not prevent the natural development of a fully stocked, normal stand. A rating of *severe* means that competition from other plants will prevent natural or artificial regeneration without intensive site preparation and maintenance treatments, including weeding.

WINDTHROW HAZARD.—This hazard represents an evaluation of the factors that control the development of tree roots and, consequently, the likelihood that trees will be uprooted by wind. A rating of *slight* indicates that trees are not expected to be blown down by wind. A rating of *moderate* indicates that some trees are expected to be blown down during periods of excessive soil wetness and high wind. If the rating is *severe*, many trees are expected to be blown down during periods of soil wetness and moderate or high winds.

SPECIES SUITABILITY.—Species suitability refers to the trees to favor in managing existing stands, and the kinds of trees best suited for planting.

SITE QUALITY.—Site quality indicates the ability of the soils to produce timber. The ratings are based on sample plots located in the county and in adjacent counties. Other soils in the county that have characteristics similar to those of the soils studied were assumed to have about the same rating. The yield information for yellow-poplar is based on data compiled by E. F. McCarthy (*12*). Information on oak is based on data compiled by G. L. Schnur (*18*). The ratings are based on the average height attained by the dominant and codominant trees at the age of 50 years. Foresters using this rating can determine the volume of timber that normal stands produce at different ages.

Site quality for yellow-poplar and upland oak is *excellent* if the site index is 95+ for yellow-poplar and 85+ for upland oak. The yield in board feet per acre at the age of 50 years is 32, 150 for yellow-poplar and more than 13,750 for upland oak. Site quality for these trees is *very good* if the site index is 85 to 94 for yellow-poplar and 75 to 84 for upland oak. Yield in board feet per acre at age of 50 years is 24,400

for yellow-poplar and 13,750 for upland oak. Site quality is *good* if the site index is 75 to 84 for yellow-poplar and 65 to 74 for upland oak. The yield in board feet per acre at the age of 50 years is 17,620 for yellow-poplar and 9,750 for upland oak. Site quality is *fair* if the site index for yellow-poplar is 65 to 74 and 55 to 64 for upland oak. The yield in board feet per acre at the age of 50 years is 11,400 for yellow-poplar and 6,300 for upland oak. Site quality is *poor* if the site index for yellow-poplar is 55 to 64 and less than 54 for upland oak. The yield in board feet per acre at the age of 50 years is 5,600 for yellow-poplar and less than 3,250 for upland oak.

The site index for other trees such as white pine, sugar maple, ash, and larch vary somewhat, but the better sites have the taller trees of the same species at the 50-year age and then decrease accordingly. More information on site index for other tree species can be obtained from the U.S.D.A. Soil Conservation Service and the Pennsylvania Bureau of Forestry.

Use of the Soils for Wildlife[4]

Many species of game, furbearers, and songbirds are abundant throughout most of Northampton County. The soils, topography, and patterns of land use are favorable for increasing the kinds and numbers of wildlife. The streams of the county provide good trout fishing and warm-water game fishing. The Delaware River provides good American shad fishing.

Under natural conditions, the patterns or combinations of vegetation in an area depend on the various kinds of soils. An area is inhabited by the kinds of wildlife that have their habitat requirements met by the vegetation in the area. If the natural conditions in the area are altered by drainage, or by other practices used in managing farmland or woodland, the kinds and patterns of vegetation change. Then, there may also be a change in the kinds and numbers of wildlife.

The soils in the county can be used for developing wildlife habitats on farms, in parks, in private or commercial shooting grounds, and in public and private wildlife refuges. Ponds can be built and stocked with fish.

Kinds of wildlife

The common kinds of wildlife in Northampton County are described in the following paragraphs. Descriptions of the soil associations referred to can be found under the heading "General Soil Map." The location of each soil association is shown on the general soil map at the back of this publication.

White-tailed deer are considered forest species, but they neither prefer nor do well in large mature forests. They prefer a combination of cover consisting of brush or young trees, a few mature trees, and small open areas. Deer can be found throughout Northampton County where there are woodlots. The largest populations are in three well-defined areas of the county. The wooded mountains along the northern edge of the county have a concentration of white-tailed deer. The soils in this part of the county are in the Laidig-Stony land and the Buchanan-Laidig-Andover associations. Although the area is predominantly mountainous, numerous small farms are along the foothills.

The steep, wooded terrain along the Delaware River in the northeast corner of the county has a small concentration of deer. The soils in this section are in the Swartswood-Wurtsboro-Chippewa and Berks-Weikert association. Williams Township, in the southern part of the county, also has a population of these animals. This area consists of wooded hillsides interspersed with farmland. About 40 percent of the terrain is wooded. The soils are in the Conestoga-Hollinger association.

Ring-necked pheasant are the most abundant game birds in Northampton County. They live throughout most of the county, except in heavily wooded areas. Populations are largest in the central part of the county. The soils in this section, which are intensively cultivated, are in associations 4, 6, and 7.

Cottontail rabbit are abundant. They thrive in most of the soil associations. Although cottontail rabbit are found in the same areas as ring-necked pheasant, the largest rabbit populations are in areas where brushy cover is interspersed with cropland and grassland. Rabbit are scarce in large cultivated fields and in dense woodlots.

Gray squirrel are also abundant throughout the county, especially where cornfields intersperse predominantly oak-hickory woodlands. They generally prefer the edges of woodland and openings in the woodland to large unbroken tracts of trees. All the soil associations in the county have areas that are suitable for squirrel.

Mourning doves nest and winter in Northampton County. During the nesting season doves frequent the towns, cities, and rural areas of the county wherever there are pines or other suitable nesting covers. Doves prefer to nest and roost in trees that grow in open areas or at the edges of such areas. They do not like dense forest but utilize evergreen plantations. Doves travel a considerable distance from roosting and nesting places to feeding areas. Small wintering populations inhabit the pines around the Hellertown reservoirs and in backyards throughout the county where bird feeding is popular.

Ruffed grouse are plentiful in associations 1 and 2 on Blue Mountain. They prefer open, brushy stands of young pine and hardwood.

Woodcock are found in limited numbers in isolated areas of the county. The largest populations occur during the fall migration, along the waterways in the northeastern corner of the county.

Raccoon and woodchuck are numerous throughout Northampton County. Woodchuck are primarily in associations that consist of well-drained soils, and raccoon live in almost all the soil associations.

Waterfowl, mainly mallard, black duck, and wood duck, are found throughout the county where there is open water. The Delaware River, East Bangor Dam, abandoned water-filled quarries, and large farm ponds provide good habitat for these migratory birds. Most of the poorly drained and very poorly drained soils are suitable for construction of shallow-water impoundments. These impoundments would attract additional waterfowl to the county.

Furbearing animals such as muskrat, skunk, mink, and fox are common. They are quite evenly distributed throughout the county.

Nongame birds and animals are numerous. Many of them, particularly the songbirds, are important because of their aesthetic value, and they eat insects and the seeds of harmful weeds. Many of the songbirds are at home in residential areas, where birdwatching is a popular pastime.

[4]By CLAYTON L. HEINEY, wildlife biologist, Soil Conservation Service.

TABLE 2.—*Soil interpretations for woodland*

Soils and map symbols	Management problems					Suitable species—	
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	Windthrow hazard	To favor in existing stands	For planting or seeding
Alluvial land: Ad. Not suited to growing trees commercially.							
Andover: AnA, AnB, AoB	Slight	Severe	Severe	Moderate	Severe	Red oak, yellow-poplar, red maple, ash, sugar maple.	White pine, larch, white spruce, yellow-poplar, Norway spruce.
Baile, neutral variant: BaB, BeB.	Slight	Severe	Severe	Moderate	Severe	Pin oak, red maple, sycamore.	White pine, white spruce.
Barbour: Bg	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	White pine, larch, Norway spruce, black walnut, yellow-poplar.
Bm. Interpretations for Bm apply to Middlebury part of unit as well as to Barbour part.	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	White pine, larch, Norway spruce, black walnut, yellow-poplar.
Bedington: BnA, BoB, BoC	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	Yellow-poplar, white pine, larch, Norway spruce, black walnut.
BpB	Slight	Moderate	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	Yellow-poplar, white pine, larch, Norway spruce, black walnut.
Berks: BrA, BrB, BrC	Slight	Slight	Moderate	Moderate for conifers; slight for hardwoods.	Slight	Red oak, white pine, Virginia pine, black oak.	Virginia pine, white pine, larch, Norway spruce, red pine.

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BrD	Slight	Moderate	Moderate	Moderate for conifers; slight for hardwoods.	Slight	Red oak, white pine, Virginia pine, black oak.	Virginia pine, white pine larch, Nor way spruce red pine.
BsF Interpretations for Berks part of BsF also apply to Weikert part.	Moderate	Severe	Severe	Slight	Moderate	Red oak, Virginia pine, chestnut oak, black oak.	Virginia pine, whit pine, red pine.
Brinkerton: BtA, BtB	Slight	Severe	Severe	Moderate	Severe	Yellow-poplar, ash, red oak, sugar maple.	Yellow-poplar, white pine, larch, white spruce, No way spruce
Buchanan:							
BuB	Slight	Slight	Slight	Moderate for conifers; slight for hardwoods.	Slight	Red oak, yellow-poplar, ash, sugar maple.	White pine, yellow-poplar, larch Norway spruce.
BvB	Slight	Moderate	Slight	Moderate for conifers; slight for hardwoods.	Slight	Red oak, yellow-poplar, ash, sugar maple.	White pine, yellow-poplar, larch, Norway spruce.
Chippewa:							
ChA	Slight	Severe	Severe	Moderate	Severe	Red maple, sycamore.	White pine, white spruce.
ChB, CkB	Slight	Severe	Severe	Moderate	Severe	Red maple, red oak, ash, sugar maple.	White pine, white spruce, larch.
Clarksburg: ClA, ClB	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, ash, sugar maple.	White pine, yellow-poplar, larch, Norway spruce.
Comly:							
CmA, CmB	Slight	Slight	Slight	Moderate for conifers; slight for hardwoods.	Slight	Red oak, yellow-poplar, sugar maple, ash.	White pine, white spruce, yellow-poplar, larch, Nor way spruce

TABLE 2.—*Soil interpretations for woodland—Continued*

Soils and map symbols	Management problems					Suitable species—	
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	Windthrow hazard	To favor in existing stands	For planting or seeding
CnB	Slight	Moderate	Slight	Moderate for conifers; slight for hardwoods.	Slight	Red oak, yellow-poplar, sugar maple, ash.	White pine, yellow-poplar, larch, Norway spruce.
Conestoga:							
CoB	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, ash, black walnut, sugar maple.	Black walnut, yellow-poplar, white pine, larch, Norway spruce.
CoC	Moderate	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, ash, black walnut, sugar maple.	Black walnut, yellow-poplar, white pine, larch, Norway spruce.
CoD	Severe	Moderate	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, ash, black walnut, sugar maple.	Black walnut, yellow-poplar, white pine, larch, Norway spruce.
CrB	Slight	Moderate	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	Black walnut, yellow-poplar, white pine, larch, Norway spruce.
CrD	Severe	Moderate	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	Black walnut, yellow-poplar, white pine, larch, Norway spruce.
CrF Interpretations for CrB, CrD, and CrF apply to Hollinger part of units as well as to Conestoga part.	Severe	Severe	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	Black walnut, yellow-poplar, white pine, larch, Norway spruce.
Conotton:							
CtA, CtB, CtC	Slight	Slight	Moderate	Moderate for conifers; slight for hardwoods.	Slight	Red oak, ash, sugar maple, yellow-poplar.	Yellow-poplar, white pine, larch, Norway spruce.

CtD	Slight	Moderate	Moderate	Moderate for conifers; slight for hardwoods.	Slight	Red oak, ash, sugar maple, yellow-poplar.	Yellow-poplar, white pine, larch, Norway spruce.
CtF	Moderate	Severe	Moderate	Moderate for conifers; slight for hardwoods.	Slight	Red oak, ash, sugar maple, yellow-poplar.	Yellow-poplar, white pine, larch, Norway spruce.
Duffield: DuA, DuB	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, black walnut, yellow-poplar, ash, sugar maple.	White pine, larch, Norway spruce, black walnut, yellow-poplar.
Halsey: Ha	Slight	Severe	Severe	Moderate	Severe	Post oak, red maple, sycamore.	White pine, white spruce.
Hollinger:							
HnB, HnC	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, ash, sugar maple.	Red pine, white pine, Virginia pine, larch, Norway spruce.
HnD	Slight	Moderate	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, ash, sugar maple.	Red pine, white pine, Virginia pine, larch, Norway spruce.
Holly: Ho	Slight	Severe	Severe	Severe	Moderate	Sycamore, pin oak, red maple.	White pine, white spruce.
Laidig:							
LaB, LaD	Slight	Moderate	Slight	Moderate for conifers; slight for hardwoods.	Slight	Red oak, yellow-poplar, sugar maple, ash.	Red pine, white pine, Virginia pine, yellow-poplar, larch, Norway spruce.
LaF	Moderate	Severe	Slight	Moderate for conifers; slight for hardwoods.	Slight	Red oak, yellow-poplar, sugar maple, ash.	Red pine, white pine, Virginia pine, yellow-poplar, larch, Norway spruce.
Middlebury: Mb	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Black walnut, yellow-poplar, red oak, ash, sugar maple.	Black walnut, yellow-poplar, white pine, larch, Norway spruce.

TABLE 2.—*Soil interpretations for woodland—Continued*

Soils and map symbols	Management problems					Suitable species—	
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	Windthrow hazard	To favor in existing stands	For planting or seeding
Muck: Mu. Not suited to growing trees commercially.							
Phelps, thick solum variant: PhB.	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Yellow-poplar, sugar maple, red oak, ash.	White pine, yellow-poplar, larch, Norway spruce.
Red Hook: Rh	Slight	Severe	Severe	Moderate	Severe	Red oak, sugar maple, ash, yellow-poplar.	White pine, yellow-poplar, Norway spruce, larch.
Rubble Land: Ru. Not suited to growing trees commercially.							
Ryder: RyB, RyC	Slight	Slight	Moderate	Moderate for conifers; slight for hardwoods.	Slight	Virginia pine, red oak, yellow-poplar, black oak.	Red pine, white pine, larch, Virginia pine, yellow-poplar, Norway spruce.
Stony Land: St. Not suited to growing trees commercially.							
Swartswood: SvB, SvC	Slight	Slight	Slight	Moderate for conifers; slight for hardwoods.	Slight	Ash, sugar maple, red oak, black oak.	White pine, larch, Norway spruce, red pine.
SvD	Slight	Moderate	Slight	Moderate for conifers; slight for hardwoods.	Slight	Ash, sugar maple, red oak, black oak.	White pine, larch, Norway spruce, red pine.
SwB, SwD. Interpretations for SwB and SwD apply to Wurtsboro part of units as well as to Swartswood part.	Slight	Moderate	Slight	Moderate for conifers; slight for hardwoods.	Slight	Ash, sugar maple, red oak, black oak.	White pine, larch, Norway spruce, red pine.
Urban Land: UrA, UrC, Us. Not suited to growing trees commercially.							

Urbana: UtB	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, ash, red maple, sugar maple.	White pine, yellow-poplar, larch, Norway spruce, red pine.
Volusia: VoB, VuB	Slight	Moderate	Moderate	Slight for conifers; moderate for hardwoods.	Moderate	Red oak, sugar maple, ash.	White pine, larch, Norway spruce.
Washington:							
WaA, WaB, WaC, WaC3	Slight	Slight	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	White pine, larch, black walnut, yellow-poplar, Norway spruce.
WaD	Moderate	Moderate	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, black walnut, ash, sugar maple.	White pine, larch, black walnut, yellow-poplar, Norway spruce.
WhF	Moderate	Severe	Slight	Severe for conifers; moderate for hardwoods.	Slight	Red oak, yellow-poplar, ash, black walnut, sugar maple.	White pine, yellow-poplar, larch, Norway spruce, black walnut.
Weikert:							
WkB, WkC	Slight	Slight	Severe	Slight	Moderate	Virginia pine, black oak, red oak, white pine.	Red pine, pitch pine, Virginia pine, white pine.
WkD	Slight	Moderate	Severe	Slight	Moderate	Virginia pine, black oak, red oak, white pine.	Red pine, pitch pine, Virginia pine, white pine.
Wurtsboro WuB, WuC	Slight	Slight	Slight	Moderate for conifers; slight for hardwoods.	Slight	Red oak, sugar maple, ash, white pine.	White pine, larch, Norway spruce.

In table 3 the soils of the county are rated according to their suitability for eight elements of wildlife habitat and three kinds of wildlife, according to the system proposed by Allan *et al.* (*1*). The ratings indicate only the potential suitability for developing, improving, or maintaining wildlife habitat and do not reflect present land use, present vegetation, size or shape of areas, or economic conditions. The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains or seed-producing annual herbaceous plants that are planted to produce food for wildlife. Examples are corn, sorghum, wheat, millet, buckwheat, soybeans, and sunflower.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted to furnish food and cover for wildlife. Examples are fescue, brome, bluegrass, timothy, redtop, orchardgrass, red canarygrass, clover, trefoil, alfalfa, and sericea lespedeza.

Wild herbaceous upland plants are native or introduced perennial grasses or forbs (weeds) that generally are established naturally and that provide food and cover, mainly for upland wildlife. Examples are ragweed, wheatgrass, wildrye, oatgrass, pokeweed, strawberry, beggarweed, goldenrod, and dandelion.

Hardwood woody plants are deciduous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs, or foliage used extensively as food for wildlife. These plants commonly are established naturally, but they also can be planted. Examples are oak, beech, cherry, hawthorn, dogwood, viburnum, holly, maple, birch, poplar, grape, honeysuckle, blueberry, and greenbrier, raspberry, rose, and various briers.

Coniferous woody plants are trees and shrubs that bear cones or berrylike cones. They are important to wildlife as cover, but they also furnish food in the form of browse, seeds, or cones. They are commonly established naturally, but they can also be planted. Examples are pine, spruce, white-cedar, hemlock, fir, redcedar, juniper, and yew.

Wetland food and cover plants are annual and perrennial wild herbaceous plants, exclusive of submerged or floating aquatic plants, that produce food or cover used mainly by wetland wildlife. Examples are smartweed, wild millet, bulrush, sedge, wild rice, switchgrass, reed canarygrass, and cattail.

Shallow-water developments are impoundments, excavated areas, and structures that control the level of the water so that the depth generally does not exceed 5 feet. Examples are low dikes and levees, shallow dugouts, level ditches, and devices for controlling the water level in marshy streams or channels.

Excavated ponds are dug-out areas or combinations of dug-out areas and low dikes that hold enough water of suitable quality and depth to support fish and wildlife. Such a pond should have a surface area of at least one-fourth of an acre and an average depth of 6 feet in at least one-fourth of the area. Also required is a water table that is permanently high or another source of unpolluted water of low acidity.

Each rating under Kinds of Wildlife in table 3 is based on the ratings listed for the habitat elements in the first part of the table. For open land wildlife the rating is based on the ratings shown for grain and seed crops, grasses and legumes, wild herbaceous upland plants, and coniferous woody plants. The rating for woodland wildlife is based on the ratings listed for grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. For wetland wildlife the rating is based on the ratings shown for wetland food and cover plants, shallow water developments, and excavated ponds. The three major groups of wildlife are described as follows.

Open land wildlife consists of birds and mammals commonly found in crop fields, in meadows and pastures, and on nonforested, overgrown land. Among these birds and mammals are ring-necked pheasant, mourning doves, woodcock, cottontail rabbit, meadowlark; killdeer, and field sparrows.

Woodland wildlife consists of birds and mammals commonly found in wooded areas. Examples are ruffed grouse, deer, squirrel,raccoon,wood thrushes, warblers, and vireos.

Wetland wildlife consists of birds and mammals commonly found in marshes and swamps. Examples are duck, geese, heron, snipe, rail, coot, muskrat, mink, and beaver.

Engineering Uses of the Soils[5]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Some of those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are slope and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information is this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 4, 5, and 6, which show, respectively, the results of engineering laboratory tests on soil samples; estimated soil properties significant in engineering; and interpretations for various engineering uses. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 6. It can also be used to make other useful maps.

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[5]Prepared in cooperation with JOHN W. MICKLEY, civil engineer, Soil Conservation Service.

With the use of the soil map for identification of soils, the engineering interpretations in this subsection can be useful for many purposes. This information, however, does not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and excavations to depths greater than those shown in the tables. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that can be expected.

Some engineering information can be obtained from the soil map. Nevertheless, it will often be necessary to refer to other parts of the soil survey, especially to the sections "Descriptions of the Soils," "Use and Management of the Soils," and "Formation and Classification of Soils."

Some of the terms used by soil scientists may be unfamiliar to the engineer, and other terms may have a special meaning in soil science. These and other special terms are defined in the Glossary in the back of this survey.

Engineering classification systems

Two systems of classifying soils are in general use among engineers; the AASHO system adopted by the American Association of State Highway Officials, and the Unified Soil Classification System used by the SCS engineers, Department of Defense, and others.

The AASHO system (*2*) is used to classify soils according to those properties that affect use in highway construction. In this system a soil is placed in one of seven basic groups, ranging from A-1 through A-7, on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation) and in group A-7 are clay soils that have low strength when wet. Within each group the relative engineering value of a soil material is indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The AASHO classification for tested soils, with index numbers in parentheses, is shown in table 4; the estimated classification for all soils mapped in the survey area is given in table 5.

In the Unified system (*23*) soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML-CL.

Engineering test data

Table 4 contains the results of engineering test performed by the Pennsylvania Department of Transportation on several important soils in Northampton County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

Moisture-density data are important in earthwork because, as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content. If a soil is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that the density decreases with the increase in moisture content. Maximum dry density is the maximum unit dry weight of the soil material when it has been compacted, at optimum moisture content, by a prescribed method of compaction. Optimum moisture content is that which gives the highest dry unit weight under the specific method of compaction.

Mechanical analysis establishes the percentages, by weight, of soil particles that can pass through sieves of specified sizes. Sand particles and other coarser materials do not pass through the No. 200 sieve. Silt and clay particles pass through the No. 200 sieve. Silt is the material more than 0.002 millimeter in diameter that passes through the No. 200 sieve, and clay is that fraction less than 0.002 millimeter in diameter that passes through the No. 200 sieve. The clay fraction was determined by the hydrometer method rather than by the pipette method most soil scientists use in determining the clay in soil samples.

Liquid limit and plasticity index indicate the effect of water on the strength of consistence of soil material. As the moisture content of clayey soil is increased from a dry state, the material changes from semisolid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material changes from semisolid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Estimated properties significant in engineering

Table 5 provides estimates of soil properties significant in engineering. The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples from this county, test data from comparable soils in adjacent areas, and experience gained in working with the soils in the survey area. The estimates of properties are ranges of values for a typical soil profile. Variations from these values are to be expected.

Depth to seasonal high water table refers to the level to which free water will rise at least once a year, measured in feet from the surface.

Depth to bedrock is measured in feet from the surface and is the range in which bedrock is encountered in most areas of a particular soil. Bedrock is the solid or fractured rock that generally underlies the soil and other unconsolidated material.

Depth from the surface is given for the significant layers for which properties have been estimated. Those layers are described in the section, "Descriptions of the Soils." Many engineering interpretations are based on the soil material below a depth of 6 to 10 inches. The soil above this depth ordinarily contains too much organic matter to be used in engineering structures, but it is commonly saved and used as topsoil to promote the growth of vegetation.

The percentages passing the various sized sieves are discussed under the heading "Engineering test data." The coarse fraction (particles more than 3 inches in diameter) was estimated in the field.

The engineering classifications are described under the heading "Engineering classification systems."

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt,""clay," and some

TABLE 3.—*Suitability of soils for wildlife habitat and for kinds of wildlife*

[Numbers in columns have the following meanings: 1, well-suited; 2, suited; 3, poorly suited; and 4, no

Soils and map symbols	Wildlife habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow-water developments	Excavated ponds	Open wild
Alluvial land: Ad	3	2	2	2	2	2	3	3	2
Andover:									
AnA	3	3	2	2	2	1	1	1	3
AnB	3	3	2	2	2	3	4	4	3
AoB	4	3	2	2	2	3	4	4	3
Baile, neutral variant:									
BaB	3	2	2	1	2	3	4	4	2
BeB	4	3	2	1	2	3	4	4	3
Barbour:									
Bg	3	2	2	1	2	2	2	4	2
Bm	2	1	1	1	3	3	3	3	1
Interpretations for Bm apply to Middlebury part of unit as well as to Barbour part.									
Bedington:									
BnA	1	1	1	1	3	4	4	4	1
BoB, BoC	2	1	1	1	3	4	4	4	1
BpB	4	3	2	1	3	4	4	4	3
Berks:									
BrA, BrB, BrC	2	2	2	2	2	4	4	4	2
BrD	3	2	2	2	2	4	4	4	2
BsF	4	4	2	2	2	4	4	4	3
Interpretations for BsF apply to Weikert part of unit as well as to Berks part.									
Brinkerton:									
BtA	3	3	2	2	2	1	1	1	3
BtB	3	3	2	2	2	3	4	4	3
Buchanan:									
BuB	2	1	1	1	3	4	4	4	1
BvB	4	3	1	1	3	3	4	3	3
Chippewa:									
ChA	4	4	2	3	3	1	1	1	4
ChB	3	3	2	2	2	3	4	4	3
CkB	4	3	2	2	2	3	4	4	4
Clarksburg:									
ClA	2	1	1	1	3	3	3	3	1
ClB	2	1	1	1	3	4	4	4	1
Comly:									
CmA	2	1	1	1	3	3	3	3	1
CmB	2	1	1	1	3	4	4	4	1
CnB	4	3	1	1	3	3	4	4	3

Conestoga:									
CoB, CoC	2	1	1	1	3	4	4	4	1
CoD	3	2	1	1	3	4	4	4	2
CrB, CrD	4	3	2	1	3	4	4	4	3
CrF	4	4	2	1	3	4	4	4	4
Interpretations for CrB, CrD, and CrF apply to Hollinger part of these units as well as to Conestoga part.									
Conotton:									
CtA	1	1	1	1	3	4	4	4	1
CtB, CtC	2	1	1	1	3	4	4	4	1
CtD	3	2	1	1	3	4	4	4	2
CtF	4	3	1	1	3	4	4	4	2
Duffield:									
DuA	1	1	1	1	3	4	4	4	1
DuB	2	1	1	1	3	4	4	4	1
Halsey: Ha	4	3	3	2	2	1	1	1	4
Hollinger:									
HnB, HnC	2	1	1	1	3	4	4	4	1
HnD	3	2	1	1	3	4	4	4	2
Holly: Ho	3	2	2	1	2	1	1	1	2
Laidig: LaB, LaD, LaF	4	3	1	1	3	4	4	4	3
Middlebury: Mb	4	3	3	1	3	3	3	4	3
Muck: Mu	4	4	4	4	4	1	1	1	4
Phelps, thick solum variant: PhB	2	1	1	1	3	4	4	4	1
Red Hook: Rh	3	2	2	1	2	1	1	1	2
Rubble land: Ru	4	4	4	4	4	4	4	4	4
Ryder: RyB, RyC	2	1	1	1	3	4	4	4	1
Stony land: St	4	4	3	3	1	4	4	4	4
Swartswood:									
SvB, SvC	2	1	1	1	3	4	4	4	1
SvD	3	2	1	1	3	4	4	4	2
SwB, SwD	4	3	1	1	3	4	4	4	3
Interpretations for SwB and SwD apply to Wurtsboro part of these units as well as to Swartswood part.									
Urban land: UrA, UrC, Us. Onsite investigation needed.									
Urbana: UtB	2	1	1	1	3	4	4	4	1
Volusia:									
VoB	3	3	2	2	2	3	4	4	3
VuB	4	3	2	2	2	3	4	4	3

TABLE 3.— *Suitability of soils for wildlife habitat and for kinds of wildlife—Continued*

Soils and map symbols	Wildlife habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow-water developments	Excavated ponds	Ope wil
Washington:									
WaA	1	1	1	1	3	4	4	4	
WaB, WaC	2	1	1	1	3	4	4	4	
WaC3	3	2	1	1	3	4	4	4	
WaD	3	2	1	1	3	4	4	4	
WhF	4	3	1	1	3	4	4	4	
Weikert:									
WkB	3	3	2	2	2	4	4	4	
WkC, WkD	4	3	2	2	2	4	4	4	
Wurtsboro: WuB, WuC	2	1	1	1	3	4	4	4	

of the other terms used in the USDA textural classification are defined in the Glossary in back of this survey.

Permeability relates to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available moisture capacity indicates the amount of cappillary water in the soil available for plant growth after all free water has drained away.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value, and relative terms used to describe soil reaction, are defined in the Glossary in the back of this survey.

Optimum moisture for compaction and maximum dry density are explained under the heading "Engineering test data." Estimates are not given for the upper layer if it is thin and consists mainly of surface soil, because this material is generally not used in engineering construction.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials.

Corrosion potential indicates the potential danger to uncoated metal or concrete surfaces through chemical action that dissolves or weakens the structural material. Buried structural materials may corrode in some kinds of soil more rapidly than in others.

Interpretations for selected engineering uses

Table 6 contains selected information useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized, but important desirable features may also be listed. The ratings and other interpretations in this table are based on estimated engineering properties given in table 5; on available test data, including those in table 4; and on field experience. The information strictly applies to the soil only at the depths indicated in table 5. It is reasonably reliable to a depth of about 5 feet for most soils and to a depth of several more feet for other soils.

Topsoil is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, used as a topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such use.

Sand and gravel ratings are based on the probability that delineated areas of the soil contain deposits of sand and gravel. The ratings do not indicate quality or size of the deposits.

Road fill material is used to build embankments. The ratings indicate performance of soil material moved from borrow areas for these purposes.

Highway and road location is influenced by features of the undisturbed soil that affect construction and maintenance of highways and roads. The soil features, favorable as well as unfavorable, are the principal ones that affect geographic location of highways and roads.

Reservoir area is affected mainly by loss of water by seepage, and the soil features are those that influence such seepage.

Embankments serve as dams. The soil features, of both subsoil and substratum, are those important to the use of soils for constructing embankments.

Drainage is influenced by features of the undisturbed soil, such as permeability, depth to water table, and seepage.

Sprinkler irrigation is influenced by features such as soil depth, available moisture capacity, permeability, and stoniness. Only sprinkler-type systems are considered.

Terraces or diversions are influenced by depth to bedrock, stoniness, seepage, and ease of obtaining vegetative cover.

Grassed waterways are influenced by depth to water table, fertility, available moisture capacity, seepage, stoniness, stability, depth to bedrock, and outlet limitations.

Winter grading is affected chiefly by soil features, especially unfavorable ones, that are relevant to moving, mixing, and compacting soil in road building when temperatures are below freezing.

Pipeline construction and maintenance are influenced by such features of the undisturbed soil as slope, depth to bedrock, depth to and duration of the water table, stoniness or rockiness, flooding, and corrosion potential.

Town and Country Planning

This section provides information about soils that should be useful in planning outdoor recreational activities and in developing land-use plans for Northampton County and its political subdivisions. Interpretive maps showing the degree and kind of limitation of the soils of any given area can be made from the soil maps and from the information in tables 7 and 8.

The information in this section offers general guidance to officials and developers who are concerned with selecting suitable uses for soils and with avoiding mistakes and costly changes in plans resulting from improper use. *It is emphasized that the soil map and the written information are restricted in detail by the map scale and should be used only in planning more detailed field investigations to determine the in-place condition of the soil at any specific site.*

Only soil features are evaluated in this section, because the ease or difficulty of making improvements is largely controlled by the characteristics of the soils. Such factors as location and economics, however, often determine the ultimate use of an area, regardless of the soil limitations involved.

Tables 7 and 8 list all the soils in the county and show the kinds and estimated degree of limitation for specific uses. Significant soil properties are depth to bedrock, permeability, flooding, depth to a seasonal high water table, texture, slope, and stoniness. Relative degrees of limitations used are *slight*, *moderate*, and *severe*. A rating of *slight* indicates that the soil generally has few limitations for the use being considered. A rating of *moderate* indicates that the soil has limitations that require special practices to overcome or correct. A rating of *severe* indicates that the soil has limitations very difficult or expensive to overcome or correct. A rating of *variable* is used for land types, because the degree of limitation is difficult to classify.

The uses for which the soils are evaluated in tables 7 and 8 are described in the following paragraphs.

Septic tank absorption fields are soil absorption systems for sewage disposal. The main features affecting use of soils for these systems are permeability, steepness of slope, depth to bedrock, and depth to the water table. In soils un-

TABLE 4.—*Engineering*

[Tests performed by the Pennsylvania Department of Transportation in accordance with standard procedures of the

Soil name and location of sample	Parent material	Pennsylvania report No.	Depth from surface	Moisture density[1/]		Fragments more than 3 inches in diameter	Mechanical analysis[2/] Percentage passing sieve—		
				Maximum dry density	Optimum moisture		3 in.	3/4 in.	No. 4 (4.7 mm.)
			In.	Lb./cu. ft.	Pct.	Pct.			
Bedington shaly silt loam——— South of Wind Gap, Plainfield Township.	Glacial till or frost-worked material from gray acid shale and sandstone.	A-13313	20-35	110	16	10	---	100	89
		A-13314	44-68	114	16	10	100	92	75
Berks shaly silt loam——— Along Legislative Route 48042 north of Nazareth, Bushkill Township.	Glacial till or frost-worked material from gray acid shale and sandstone.	67-12408	12-24	112	16	--	100	93	64
		67-12410	24-36	113	16	--	100	70	42
Chippewa extremely stony silt loam——— 0.75 mile south of East Bangor, Washington Township.	Glacial till from gray slate, shale, quartzite, sandstone, and some limestone.	67-36649	11-17	112	14	--	100	84	77
		67-36650	54-64	121	12	--	100	86	77
Comly silt loam——— South of State Route 946, west of Danielsville, Lehigh Township.	Glacial till or frost-worked material from gray acid shale and sandstone.	67-36639	9-18	118	13	--	100	100	96
		67-36640	32-60	117	14	--	100	93	87
Conotton gravelly silt loam——— Intersection of Legislative Route 48073 and Township Road T716, Upper Mount Bethel Township.	Glacial outwash.	67-36653	28-48	120	11	--	100	91	77
		67-36654	48-88	128	10	11	100	64	44
Halsey silt loam——— 0.75 mile northeast of Five Points, Upper Mount Bethel Township.	Glacial outwash.	68-24463	14-28	127	9	--	100	96	89
		68-24464	40-50	126	9	--	100	72	61
Swartswood gravelly loam——— 0.75 mile northwest of Portland, Upper Mount Bethel Township.	Glacial till from gray slate, shale, quartzite, sandstone, and some limestone.	67-21861	20-26	126	10	7	100	83	76
		67-21862	75-88	126	9	4	100	86	76
Volusia gravelly silt loam——— 2 miles south of East Bangor, Washington Township.	Glacial till from gray slate, shale, quartzite, sandstone, and some limestone.	67-42524	9-17	114	14	--	100	97	90
		67-42525	17-81	120	13	--	100	80	70

test data

American Association of State Highway Officials (AASHO). Absence of an entry indicates no determination was made]

Mechanical analysis[2]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued			Percentage smaller than—							
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO	Unified[3]
81	73	66	65	53	28	20	33	9	A-4(6)	ML-CL
66	62	53	52	43	24	16	31	8	A-4(4)	ML-CL
51	37	34	33	28	17	11	39	12	A-2-6(0)	GM-GC
31	19	15	14	13	8	5	38	12	A-2-6(0)	GM-GC
75	65	47	41	31	17	10	26	2	A-4(2)	SM
71	60	42	37	27	16	11	21	3	A-4(1)	SM
92	82	66	57	46	28	20	27	9	A-4(6)	CL
82	70	54	48	41	29	24	31	10	A-4(4)	ML-CL
69	56	42	37	24	13	8	19	1	A-4(1)	SM
36	20	12	10	7	5	4	19	1	A-1-a(0)	GM-GW
84	66	41	35	20	11	6	18	1	A-4(1)	SM
55	41	28	23	13	6	4	20	1	A-2-4(0)	GM
69	62	39	35	20	12	9	17	2	A-4(1)	SM
70	54	29	25	15	8	5	14	4/NP	A-2-4(0)	SM
85	76	64	58	46	27	17	29	10	A-4(6)	CL
64	54	41	37	30	19	13	26	6	A-4(1)	GM-GC

TABLE 4.—*Engineering*

Soil name and location of sample	Parent material	Pennsylvania Report No.	Depth from surface	Moisture density[1]		Fragments more than 3 inches in diameter	Mechanical analysis[2]		
				Maximum dry density	Optimum moisture		Percentage passing sieve—		
							3 in.	3/4 in.	No. 4 (4.7 mm.)
			In.	Lb./cu. ft.	Pct.	Pct.			
Washington silt loam_ Edward C. Tracy Elementary School on Legislative Route 48019, Palmer Township.	Glacial till or frost-worked material largely from limestone.	67-8805	30-72	107	20	--	--	100	98
		67-8806	72-96	109	17	--	--	100	98
Wurtsboro gravelly silt loam_____ 0.5 mile south of East Bangor, Washington Township.	Glacial till from gray slate, shale, quartzite sandstone, and some limestone.	67-36637	20-28	122	12	--	100	98	90
		67-36638	62-76	122	11	--	100	86	78

[1] Based on AASHO Designation: T99-57, Method A (2).

[2] Mechanical analysis according to AASHO Designation T88-57(2). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is

derlain by cavernous limestone, fractured slate, or shale and sand or gravel, the underground water may become contaminated by seepage of effluent through rock crevices, coarse materials, or solution channels. The size of the drainage field and the type of disposal system used are often determined by the degree and kind of limitation. Where the rating is *severe* the soils should be carefully investigated before decisions are made concerning installation of disposal systems. For systems used only for short periods, such as for summer camps, limitations may be less severe than indicated in the table.

Sewage lagoons are shallow lakes used to hold sewage for the time required for bacterial decomposition. The main features affecting use of soils for sewage lagoons are permeability of the substratum, slope, depth of bedrock, stoniness, and flood hazard. The dwellings considered in table 7 are homes of three stories or less with basements that have excavations of less than 8 feet. The main features affecting soil use for this purpose are depth to seasonal high water table, depth to and kind of bedrock, degree of slope, and flood hazard. Depth to bedrock and the presence of a high water table are less severe limitations if buildings are constructed without basements.

For lawns and landscaping suitable soil material is needed in amounts sufficient for desirable trees and other plants to survive and grow. In these ratings the need for lime and fertilizer are not considered. Among the features considered in the soil ratings on table 7 are: depth to seasonal high water table, degree of slope, depth to bedrock, texture, presence of stones or rocks, and flood hazard.

The main features affecting use of soils for *streets and parking lots in subdivisions* are depth to seasonal high water table, degree of slope, depth to and kind of bedrock, stoniness, and flood hazard. For roads outside of subdivisions, slope limitations are generally less severe than indicated in table 7.

Sanitary landfills are areas used for the disposal of trash and garbage in dug trenches. The main requirement is sufficient soil material to cover the refuse and garbage. Transporting fill or cover material from a source away from the site is not considered in the ratings. The main soil features considered are depth to bedrock, flood hazard, seasonal high water table, and presence of stones or rocks. Sinkholes in limestone are not suitable for refuse disposal, because of risk of contamination of ground-water supplies. Esthetic, economic, and sociological factors, though important, are not considered in the ratings.

The main features affecting use of soils for *cemeteries* are depth to bedrock, flood hazard, rockiness, stoniness, and soil texture.

Campsites are areas used intensively for tents, camping trailers, travel trailers, and the accompanying activities of outdoor living. These areas are used frequently during the camping season, which generally extends from May 30 until Labor Day. Little site preparation is required, other than shaping and leveling the tent and parking areas. The sites are subject to heavy foot traffic and vehicular traffic. Suitability of soil for supporting vegetation is a separate item to be considered in the final evaluation in selecting sites for these uses.

Service buildings (without basements) in recreational areas are constructed for use as sites for service buildings, washrooms, bathhouses, picnic shelters, and seasonal or

test data—Continued

Mechanical analysis[2]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued			Percentage smaller than—							
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO	Unified[3]
96	88	77	72	60	47	40	36	14	A-6(10)	ML-CL
96	91	74	68	56	36	27	30	6	A-4(8)	ML-CL
83	72	54	45	32	18	13	24	5	A-4(4)	CL
72	61	43	38	27	19	13	21	6	A-4(2)	SM-SC

excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming USDA textural classes for soils.

[3] SCS and Bureau of Public Roads have agreed that any soil having a plasticity index within 2 points of the A-line is to be given a borderline classification. An example of a borderline classification is ML-CL.

[4] NP Nonplastic.

year-round cottages. Soil limitations for buildings with basements are given in table 7.

Paths and trails in camping areas are used for travel by foot or horseback and for other nonintensive uses which allow for random movement of people. These areas will be used as they occur in nature and little or no cutting and filling is needed.

Picnic and play areas are natural or landscaped tracts used for hiking, picnicking, and casual play where only light foot traffic is expected. The ratings are based on soil features only and do not include other features such as the presence of trees or lakes, which may affect the desirability of a site. The main soil features considered are depth to seasonal high water table, slope, depth to bedrock, flood hazard, and the presence of rocks and stones. Water supply, sewage disposal, and suitability of the soil for supporting vegetation should be considered in the final evaluation in selecting sites for these uses.

Athletic fields apply to areas to be developed as playgrounds for organized games such as baseball, football, badminton, and the like. Areas selected for this use are subject to intensive foot traffic; therefore, a nearly level surface, good drainage, and a soil texture and consistence which gives a firm surface are generally required. The most desirable soils are also free of rock outcrops, and stones are few. Good vegetation cover can be established and maintained on areas where needed.

The ratings of the soils for *golf fairways* are based on the suitability of the soils for providing a good turf and for growing shrubs and trees without adding topsoil. Traps, roughs, and greens are specialized features and are not considered in the soil ratings for golf fairways. Among the factors considered are depth to seasonal high water table, slope, depth to bedrock, texture, presence of rocks or stones, and flood hazard.

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or necessary to follow carefully the instructions for referring to other series

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Coarse fraction (3 inches)	Percentage passing sieve—				Classification
	Seasonal high water table	Bedrock			No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Unified
	Ft.	Ft.	In.	Pct.					
Alluvial land: Ad. Requires onsite investigation.									
Andover: AnA, AnB, AoB	0-1	> 6	0-9	0-10	80-95	65-90	60-85	45-75	ML, CL, SM, SC
			9-44	0-10	80-100	65-100	60-95	30-70	SM, SC, ML, CL
			44-60	5-15	45-85	50-80	45-70	20-45	SM, SC, GM, GC
Baile, neutral variant: BaB, BeB	0-1	> 5	0-10	0-5	95-100	90-100	80-95	60-75	ML
			10-30	15-20	95-100	80-100	80-95	65-85	CL, MH
			30-52	----------	85-95	80-90	75-85	60-75	MH
*Barbour: Bg, Bm For properties of Middlebury soils in Bm unit, see the Middlebury series.	> 3	> 6	0-28	----------	65-90	60-80	55-75	40-65	ML, SM, SC
			28-64	0-5	50-75	45-60	40-50	20-45	GM, SM
Bedington: BnA, BoB, BoC, BpB	> 3	> 4	0-15	----------	70-100	65-95	60-90	40-65	ML, GM
			15-48	0-10	70-100	65-95	60-90	40-70	ML, CL, GM, GC
			48-60	0-10	55-90	40-80	40-80	30-55	GM, GC, SM, SC, ML, CL
			60	----------	----------	----------	----------	----------	----------
*Berks: BrA, BrB, BrC, BrD, BsF For properties of Weikert soils in BsF unit, see the Weikert series.	> 3	1 1/2-3 1/2	0-9	0-20	55-90	50-85	35-60	25-60	GM, ML, GC
			9-28	0-30	40-70	35-60	20-60	15-45	GM, GC, SM
			28-38	0-40	30-65	25-55	15-45	15-35	GM, GC, SM
			38	----------	----------	----------	----------	----------	----------
Brinkerton: BtA, BtB	0-1/2	> 5	0-9	----------	80-100	75-95	60-90	50-80	ML, CL
			9-36	----------	80-100	75-100	60-90	50-80	ML, CL
			36-60	0-15	70-90	20-85	20-80	10-65	GM, GC, ML, CL
Buchanan: BuB, BvB	1-3	> 5	0-8	0-10	80-100	75-95	55-80	30-70	ML, CL, SM, GM
			8-37	0-20	75-100	75-95	55-80	30-70	ML, CL, SM, GM
			37-66	0-20	45-80	40-75	35-70	20-55	SM, ML, CL, GM
Chippewa: ChA, ChB, CkB	0-1/2	>6	0-17	0-5	70-100	65-90	65-85	45-80	ML, CL, SM
			17-80	5-15	70-90	65-90	50-80	40-65	SM, GC, GM, ML, CL

significant in engineering

more kinds of soil. The soils in such mapping units may have different properties, and for this reason it is that appear in the first column of this table. >=more than; <=less than]

Classification—Continued		Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential	
AASHO	USDA texture (typical profile)							Uncoated steel	Concrete
		In./hr.	In./in. of soil	pH	Pct.	Lb./cu. ft.			
A-4	Gravelly loam, gravelly silt loam.	0.2-6.3	0.11-0.15	4.5-5.5			Low	High	Moderate.
A-2, A-4	Gravelly silt loam, gravelly loam (fragipan).	<0.2	0.12-0.18	4.5-5.5	12-17	118-125	Low	Moderate	Moderate.
A-2, A-4	Very gravelly loam.	0.2-6.3	0.10-0.14	5.1-6.0	10-14	120-126	Low	Moderate	Moderate.
A-4	Silt loam	0.2-0.63	0.18-0.20	6.1-7.3			Low	Moderate	Moderate.
A-6, A-7	Silty clay loam, cobbly silt loam.	<0.2	0.15-0.18	6.1-7.3	17-21	101-110	Moderate	Moderate	Moderate.
A-5	Gravelly loam	<0.2	0.14-0.18	6.1-7.3	12-16	101-110	Moderate	Moderate	Moderate.
A-4	Fine sandy loam	2.0-6.3	0.10-0.12	5.6-6.5	10-14	110-120	Low	Moderate	Moderate.
A-2, A-4	Fine sand, sand	2.0-6.3	0.03-0.06	6.1-7.3	8-12	115-120	Low	Low	Moderate.
A-4	Shaly silt loam	0.63-2.0	0.13-0.19	6.1-7.3	14-18	110-118	Low	Moderate	Moderate.
A-4, A-6	Shaly silt loam	0.63-2.0	0.13-0.19	6.1-7.3	14-18	110-118	Low	Moderate	High.
A-2, A-4	Very shaly loam	2.0-6.3	0.08-0.16	5.6-7.3	12-18	114-120	Low	Moderate	High.
	Shale bedrock								
A-2, A-4	Shaly silt loam	2.0-6.3	0.10-0.17	6.6-7.3			Low	Low	Moderate.
A-1, A-2, A-4	Shaly silt loam	2.0-6.3	0.07-0.12	5.6-6.5	14-19	110-116	Low	Low	Moderate.
A-1, A-2	Very shaly silt loam.	2.0-6.3	0.05-0.11	5.6-6.5	13-19	105-116	Low	Low	Moderate.
	Fractured shale bedrock.								
A-4	Silt loam	0.2-0.63	0.15-0.19	6.6-7.3			Low	High	High.
A-4, A-6, A-7	Silty clay loam	< 0.2	0.13-0.16	5.6-6.5	17-21	100-112	Moderate	High	High.
A-1, A-2, A-4, A-7	Very shaly loam, shaly silty clay loam.	0.2-2.0	0.04-0.15	5.6-6.5	14-19	108-116	Low	High	High.
A-2, A-4	Gravelly loam	0.63-6.3	0.13-0.16	5.1-6.0			Low	Moderate	Moderate.
A-2, A-4 A-6	Silt loam, clay loam.	0.2-0.63	0.13-0.16	5.1-6.0	12-16	114-120	Low	Moderate	High.
A-2, A-4	Gravelly loam, very shaly loam (fragipan).	< 0.2	0.07-0.13	5.1-6.0	10-14	116-124	Low	Moderate	High.
A-4	Silt loam, gravelly loam.	0.2-6.3	0.12-0.16	5.6-6.5	11-18	110-115	Moderate	High	Moderate.
A-4, A-6	Gravelly loam (fragipan).	< 0.2	0.11-0.15	5.6-7.3	11-18	110-122	Moderate	High	Moderate.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Coarse fraction (3 inches)	Percentage passing sieve—				Classification
	Seasonal high water table	Bedrock			No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Unified
	Ft.	Ft.	In.	Pct.					
Clarksburg: ClA, ClB	1 1/2-3	>6	0-18	----------	95-100	90-100	80-95	79-90	ML
			18-42	----------	95-100	90-100	80-95	75-90	ML
			42-60	0-5	95-100	80-95	75-90	40-80	ML, SM
Comly: CmA, CmB, CnB	1/2-3	>4	0-9	----------	80-90	75-90	60-90	55-85	ML
			9-26	----------	80-100	75-100	60-90	55-85	ML, CL
			26-60	----------	70-90	65-85	30-75	30-70	GM, ML, CL
*Conestoga: CoB, CoC, CoD, CrB, CrD, CrF. For properties of Hollinger soils in units CrB, CrD, CrF, see the Hollinger series.	>3	>5	0-18	----------	90-100	90-100	75-90	55-75	ML
			18-38	----------	85-100	75-100	65-95	40-70	SM, SC, ML, CL
			36-60	----------	85-100	75-100	60-95	30-65	SM, SC, ML
Conotton: CtA, CtB, CtC, CtD, CtF	>3	>5	0-28	0-20	50-80	30-70	15-65	10-55	ML, GM, GP
			28-48	0-25	50-90	35-70	10-60	10-45	GM, SM, GW, GP
			48-88	0-25	25-90	20-60	5-35	5-20	GP, GW, GM, SM
Duffield: DuA, DuB	>3	>5	0-10	----------	95-100	95-100	85-95	60-85	ML
			10-60	----------	95-100	95-100	85-100	70-85	ML, CL
			60-72	15-20	85-100	75-90	65-85	50-75	ML, CL
Halsey: Ha	0	>6	0-14	----------	80-95	75-90	60-75	55-65	ML, CL
			14-34	----------	60-90	60-85	35-70	25-45	SM, SC, GM, GC
			34-50	0-20	40-65	35-60	20-50	10-35	GP, GM, SP
Hollinger: HnB, HnC, HnD	>3	>4	0-8	0-10	80-100	65-95	60-90	55-75	ML
			8-24	0-10	80-100	65-95	55-90	35-70	ML, SM
			24-50	15-35	80-100	45-75	45-65	35-65	ML, SM
Holly: Ho	0-1/2	>5	0-40	----------	95-100	90-100	90-100	70-85	ML, CL
			40-68	----------	90-100	80-95	55-75	45-70	SM, ML, CL
Laidig: LaB, LaD, LaF	>3	>5	0-16	0-10	70-90	65-85	40-55	20-45	GM, SM
			16-40	5-20	70-95	65-90	40-55	20-45	GM, GC, SM, SC
			40-80	5-20	50-75	45-75	40-55	15-40	GM, GC, SM, SC
Middlebury: Mb	1-2 1/2	>4	0-32	----------	95-100	85-100	50-80	35-70	ML, GM, GC
			32-50	----------	85-100	75-100	40-70	30-55	ML, SM, GM
Muck: Mu. Requires onsite investigation.									

significant in engineering—Continued

Classification—Continued		Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential	
AASHO	USDA texture (typical profile)							Uncoated steel	Concrete
		In./hr	In./in. of soil	pH	Pct.	Lb./cu. ft.			
A-4	Silt loam	0.63-2.0	0.18-0.20	7.4-8.4	15-19	105-115	Low	Moderate	Moderate.
A-4, A-6	Silt loam (fragipan).	<0.2	0.18-0.20	6.6-7.8	15-19	105-115	Moderate	Moderate	Moderate.
A-4	Gravelly sandy loam.	0.2-0.63	0.12-0.15	7.4-7.8	15-19	105-115	Moderate	Moderate	Moderate.
A-4	Silt loam	0.63-6.3	0.15-0.18	6.6-7.3			Low	Moderate	High.
A-4, A-6	Silt loam, silty clay loam.	0.63-2.0	0.14-0.18	6.1-7.3	11-16	110-118	Low	Moderate	High.
A-4, A-4	Loam, silt loam (fragipan)	0.2-0.63	0.10-0.13	5.6-6.5	9-15	113-122	Low	Moderate	High.
A-4	Silt loam	0.63-2.0	0.18-0.20	6.1-7.3	11-18	108-115	Low	Moderate	Moderate.
A-4, A-5, A-6	Silt loam, silty clay loam.	0.63-2.0	0.14-0.18	6.1-7.3	13-19	108-115	Low	Low	Moderate.
A-2, A-4, A-5	Loam, sandy loam	2.0-6.3	0.12-0.16	6.1-7.3	10-16	108-115	Low	Low	High.
A-1, A-4, A-4	Gravelly silt loam, gravelly loam, very gravelly loam.	>6.3	0.05-0.12	5.1-6.5	11-18	115-122	Low	Moderate	Moderate.
A-1, A-2, A-4	Gravelly loam	>6.3	0.06-0.12	5.1-7.3	10-15	115-126	Low	Low	Moderate.
A-1, A-2	Very gravelly sandy loam.	>6.3	0.03-0.09	6.1-7.3	6-11	125-130	Low	Low	Moderate.
A-4	Silt loam	0.63-2.0	0.19-0.20	6.1-7.3			Low	Low	Moderate.
A-4, A-6	Silt loam	0.63-2.0	0.19-0.20	6.1-7.3	14-22	100-105	Moderate	Moderate	Moderate.
A-4	Channery silt loam.	0.63-2.0	0.15-0.18	6.1-7.3	15-20	105-110	Low	Moderate	High.
A-4, A-6	Silt loam, silty clay loam.	0.63-2.0	0.15-0.18	6.6-7.3	11-18	108-115	Low	High	Moderate.
A-1, A-2, A-4	Gravelly loam, very gravelly loam.	0.2-2.0	0.10-0.14	6.6-7.8	9-18	105-127	Low	High	Moderate.
A-1, A-2	Very gravelly sandy loam.	0.63-6.3	0.05-0.08	7.9-8.4	8-12	115-125	Low	High	Moderate.
A-4	Gravelly silt loam.	0.63-2.0	0.13-0.19	6.6-7.3			Low	Moderate	Moderate.
A-4, A-6	Gravelly silt loam.	0.63-2.0	0.13-0.19	6.6-7.3	13-18	110-118	Low	Low	Moderate.
A-4- A-5	Very channery loam.	0.63-6.3	0.08-0.13	6.6-7.3	13-18	110-118	Low	Low	High.
A-4, A-6	Silt loam	0.63-2.0	0.18-0.20	5.6-6.5	15-20	105-115	Moderate	High	Moderate.
A-4	Loam, sandy loam	0.63-2.0	0.13-0.15	6.1-7.3	8-12	115-125	Low	High	Moderate.
A-2, A-4	Silt loam, loam, gravelly silt loam.	0.63-6.3	0.13-0.17	5.1-6.5	11-18	110-115	Low	Low	High.
A-2, A-4	Clay loam, gravelly sandy clay loam.	0.63-2.0	0.09-0.13	5.6-6.0	10-15	115-125	Low	Low	High.
A-2, A-4	Gravelly loam, cobbly sandy loam (fragipan).	0.2-0.63	0.08-0.13	5.1-6.0	10-14	120-128	Low	Low	High.
A-4	Silt loam, sandy loam, loam.	0.63-2.0	0.15-0.17	6.1-7.3	10-14	110-120	Moderate	Moderate	Moderate.
A-2, A-4	Sandy loam, loamy sand.	0.63-6.3	0.08-0.10	6.1-7.3	8-12	115-120	Low	Moderate	Moderate.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Coarse fraction (3 inches)	Percentage passing sieve—				Classification
	Seasonal high water table	Bedrock			No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Unified
	Ft.	Ft.	In.	Pct.					
Phelps, thick solum variant: PhB	1 1/2-3	>6	0-10	0-10	85-100	75-95	25-70	25-55	GM, GC, ML, CL
			10-24	0-5	80-100	70-100	60-90	50-85	ML, CL
			24-70	10-30	40-90	35-85	25-65	15-55	GM, GC, SM, SC, ML, CL
Red Hook: Rh	1/2-1 1/2	>6	0-10	----------	85-100	85-100	65-95	35-75	ML, SM
			10-35	----------	85-100	80-100	65-95	60-75	ML
			35-62	----------	80-100	75-100	60-95	5-55	SM, SP, CL, ML
Rubble land: Ru. Requires onsite investigation.									
Ryder: RyB, RyC	>3	2-3 1/2	0-8	----------	85-100	80-100	75-95	65-85	ML
			8-28	----------	85-100	80-100	75-95	65-85	ML, CL
			28-32	15-25	60-90	50-80	20-45	15-35	GM, GC, SM
			32	----------	----------	----------	----------	----------	----------
Stony land: St. Requires onsite investigation.									
*Swartswood: SvB, SvC, SvD, SwB, SwD For properties of Wurtsboro soils in the units SwB and SwD, see the Wurtsboro series.	>2 1/2	>6	0-20	15-20	65-85	60-80	45-70	25-45	SM
			20-88	15-35	55-80	45-75	35-65	15-45	SM, GM
Urban land: UrA, UrC, Us. Requires onsite investigation.									
Urbana: UtB	1 1/2-3	>4	0-19	----------	85-100	85-95	75-85	65-80	ML, CL
			19-38	0-5	85-100	80-100	80-95	65-90	ML, CL
			38-50	----------	75-90	75-90	65-80	36-65	SM, SC, ML
Volusia: VoB, VuB	1/2-1 1/2	>6	0-17	0-20	70-95	60-90	55-80	45-70	ML, GM, CL
			17-81	0-20	65-90	55-80	50-75	40-65	GM, GC, ML, CL
Washington: WaA, WaB, WaC, WaC3, WaD, WhF	>3	>6	0-10	----------	80-100	75-95	65-90	55-85	ML
			10-72	----------	80-100	75-100	65-95	55-85	ML, CL
			72-96	0-15	65-100	60-100	50-95	30-80	CL, ML, SC, GM

significant in engineering—Continued

Classification—Continued		Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential	
AASHO	USDA texture (typical profile)							Uncoated steel	Concrete
		In./hr.	In./in. of soil	pH	Pct.	Lb./cu. ft.			
A-2, A-4	Gravelly silt loam, fine sandy loam.	0.63-2.0	0.13-0.17	5.1-6.0			Low	Moderate	Low.
A-4, A-6	Silt loam, silty clay loam.	0.2-0.63	0.14-0.18	5.1-6.0	14-18	105-115	Low	Moderate	Low.
A-2, A-4	Gravelly sandy clay loam, sandy clay loam, gravelly sand, gravelly sandy loam.	0.2-6.3	0.05-0.10	5.1-7.3	6-11	128-138	Low	Moderate	Low.
A-4	Gravelly silt loam, sandy loam.	0.63-2.0	0.14-0.17	5.1-6.5			Low.		
A-4	Loam, very fine sandy loam.	0.2-0.63	0.14-0.17	5.1-6.5	13-17	110-120	Low	High	High.
A-1, A-2, A-3, A-4	Loamy sand, clay loam.	0.63-6.3	0.08-0.12	5.5-7.3	10-15	100-120	Low	High	High.
A-4, A-6	Silt Loam	0.63-2.0	0.16-0.20	6.6-8.4			Low	Moderate	Moderate.
A-4, A-6	Silt loam, silty clay loam.	0.63-2.0	0.16-0.18	6.6-7.3	18-25	95-115	Low	Moderate	Moderate.
A-1, A-2	Channery silt loam.	0.63-2.0	0.10-0.16	6.6-7.3	18-25	95-115	Low	Moderate	Moderate.
	Thin bedded shaly limestone.								
A-2, A-4	Gravelly loam	0.63-6.3	0.11-0.15	5.6-6.5	10-14	118-126	Low	Low	High.
A-1, A-2	Gravelly sandy loam, very gravelly sandy loam (fragipan).	0.63-2.0	0.07-0.11	5.1-6.5	9-12	122-130	Low	Low	High.
A-4	Silt Loam	0.63-2.0	0.17-0.19	6.1-7.3	11-18	108-115	Low	High	High.
A-4	Loam, gravelly loam (fragipan).	0.2-0.63	0.14-0.17	5.6-6.5	14-18	104-111	Low	High	High.
A-4	Sandy loam	0.2-0.63	0.11-0.12	5.6-6.5	14-17	105-115	Low	High	High.
A-4	Gravelly silt loam gravelly loam.	0.63-2.0	0.11-0.15	5.6-6.5	12-16	110-120	Low	High	Moderate.
A-4	Gravelly loam (fragipan).	<0.2	0.09-0.14	5.1-6.5	12-16	116-124	Low	High	Moderate.
A-4	Silt loam	0.63-2.0	0.15-0.19	6.6-7.3			Low	Moderate	Moderate.
A-4, A-6, A-7	Silty clay loam, clay loam.	0.63-2.0	0.12-0.14	6.6-7.3	13-20	105-114	Low	Low	Moderate.
A-2, A-4, A-6	Loam	0.63-2.0	0.10-0.17	6.6-7.8	13-18	108-114	Low	Low	Moderate.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Coarse fraction (3 inches)	Percentage passing sieve—				Classification
	Seasonal high water table	Bedrock			No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Unified
	Ft.	Ft.	In.	Pct.					
Weikert: WkB, WkC, WkD	>3	1-1 1/2	0-8	10-20	30-70	25-65	25-60	20-55	GM, ML
			8-16	0-20	25-55	20-40	10-35	5-25	GM, GP
			16						
Wurtsboro: WuB, WuC	1 1/2-3	>5	0-28	0-10	70-95	65-90	55-85	30-60	SM, ML, CL
			28-76	5-15	65-90	60-85	55-80	25-55	SM, SC, ML, CL

significant in engineering—Continued

Classification—Continued		Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential	
AASHO	USDA texture (typical profile)							Uncoated steel	Concrete
		In./hr.	In./in. of soil	pH	Pct.	Lb./cu. ft.			
A-1, A-2, A-4	Channery silt loam.	2.0-6.3	0.05-0.13	5.6-6.5			Low	Low	High.
A-1, A-2	Very shaly silt loam.	2.0-6.3	0.04-0.08	6.1-7.3	11-15	115-122	Low	Low	High.
	Fractured shale, siltstone and thin bedded sandstone.								
A-2, A-4	Gravelly silt loam, gravelly loam.	0.63-2.0	0.13-0.18	5.6-6.5	10-16	110-122	Low	Moderate	High.
A-2, A-4	Gravelly loam, very gravelly loam (fragipan).	0.2-0.63	0.10-0.14	5.1-6.5	9-15	115-130	Low	Moderate	High.

TABLE 6.—*Interpretations for*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or reason it is necessary to follow carefully the instructions for referring

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir area	Embankment
Alluvial land: Ad.	Poor: contains coal washings.	Poor: locally good below a depth of 45 inches.	Good to fair: seasonal high water table.	Seasonal high water table; flooding.	Pervious material.	Fair stability; poor resistance to piping.
Andover: AnA, AnB, AoB.	Fair: high water table; stony phases poor.	Unsuitable: excessive fines.	Fair to good; high water table; stones in places; A-2, A-4 material.	High water table; moderate to high frost heave potential; seepage above fragipan; stones in places.	High water table; pervious layers in substratum.	Fair stability; stones in places.
Baile, neutral variant: BaB, BeB.	Fair: high water table; stony phases poor.	Unsuitable: excessive fines.	Poor: high water table; low to moderate shrink-swell potential; stones in places; A-5, A-6, A-7 material.	High water table; high frost heave potential; seepy areas; stones in places.	High water table.	Fair to poor stability; fair to very poor compaction; fair resistance to piping; stones in places.
*Barbour: Bg, Bm. For interpretations of Middlebury soil in Bm unit, see the Middlebury series.	Good	Poor: locally good below a depth of 28 inches.	Good to fair: A-2, A-4 material.	Flooding	Moderately rapid permeability.	Fair stability; poor resistance to piping below a depth of 4 feet.
Bedington: BnA, BoB, BoC, BpB.	Good: some shale fragments; stony phases poor.	Unsuitable: excessive fines.	Good to fair: A-4, A-6 to a depth of about 4 feet; underlain by shaly A-2, A-4 material.	Moderate to high frost heave potential; stones in places.	Pervious substratum.	Fair to poor stability, compaction, and resistance to piping; stones in places.
*Berks: BrA, BrB, BrC, BrD, BsF. For interpretations of Weikert soils in BsF unit, see the Weikert series.	Fair: shaly	Unsuitable: excessive fines.	Fair to good: A-1, A-2, A-4 material.	Weathered bedrock at a depth of 1 1/2 to 3 1/2 feet.	Pervious bedrock at a depth of 1 1/2 to 3 1/2 feet.	Fair stability; poor resistance to piping.
Brinkerton: BtA, BtB.	Fair: high water table.	Unsuitable: excessive fines.	Fair to poor: high water table; A-1, A-2, A-4, A-6, A-7 material.	High water table; high frost heave potential; seepage above fragipan.	High water table; pervious substratum.	Fair stability; piping hazard.
Buchanan: BuB, BvB.	Fair: gravelly; stony phases poor.	Unsuitable: excessive fines.	Fair: seasonal high water table; A-2, A-4, A-6 material.	Seasonal high water table; moderate to high frost heave potential; seepage above fragipan; stones in places.	Seasonal high water table.	Fair stability; fair to poor resistance to piping; stones in places.

selected engineering uses

more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this to other series that appear in the first column of this table]

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Seasonal high water table; flooding.	Flooding	Nearly level	Seasonal high water table; low fertility.	Susceptible to formation of frozen clods.	Subject to caving; flooding.
High water table; slow permeability.	High water table; slow permeability; stones in places.	Slow permeability; stones in places; high water table.	High water table; seepage above fragipan; stones in places.	High water table; susceptible to formation of frozen clods; stones in places.	High water table; seepage above fragipan; stones in places.
High water table; slow permeability.	High water table; slow permeability.	Slow permeability; stones in places.	High water table; seepy areas; stones in places.	High water table; poor trafficability; susceptible to formation of frozen clods; stones in places.	High water table; seepy areas; stones in places.
Well drained	Moderately rapid permeability; moderate available moisture capacity; flooding.	Nearly level	Moderate available moisture capacity; fair stability.	Susceptible to formation of frozen clods.	Subject to caving; flooding.
Well drained	Moderate permeability; moderate to high available moisture capacity; stones in places.	Moderate permeability; stones in places.	Moderate to high available moisture capacity; fair to poor stability; stones in places.	Fair trafficability; susceptible to formation of frozen clods; stones in places.	High corrosion potential.
Well drained	Moderate to low available moisture capacity; bedrock at a depth of 1 1/2 to 3 1/2 feet.	Weathered bedrock at a depth of 1 1/2 to 3 1/2 feet.	Moderate to low available moisture capacity; weathered bedrock at a depth of 1 1/2 to 3 1 /2 feet.	Fair compaction	Weathered bedrock at a depth of 1 1/2 to 3 1/2 feet.
High water table; slow permeability.	High water table; slow permeability; low available moisture capacity.	Slow permeability; fair stability.	High water table; low available moisture capacity; seepage above fragipan.	High water table; susceptible to formation of frozen clods.	High water table; seepage above fragipan; high corrosion potential.
Seasonal high water table; slow permeability.	Seasonal high water table; slow permeability; stones in places.	Slow permeability; stones in places.	Seasonal high water table; seepage above fragipan; stones in places.	Seasonal high water table; susceptible to formation of frozen clods; stones in places.	Seasonal high water table; seepage above fragipan; high corrosion potential; stones in places.

TABLE 6.—*Interpretations for*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir area	Embankment
Chippewa: ChA, ChB, CkB.	Fair: high water table; stony phases poor.	Unsuitable: excessive fines.	Fair: high water table; A-4, A-6 material.	High water table; moderate frost heave potential; stones in places.	High water table.	Fair stability; fair resistance to piping; stones in places.
Clarksburg: ClA, ClB.	Good; seasonal high water table.	Unsuitable: excessive fines.	Fair to good: low to moderate shrink-swell potential; A-4, A-6 material.	Seasonal high water table; high frost heave potential.	Seasonal high water table; possible sinks and solution channels.	Poor stability and compaction; fair to poor resistance to piping.
Comly: CmA, CmB, CnB.	Fair: seasonal high water table; stony phases poor.	Unsuitable: excessive fines.	Fair to poor: seasonal high water table; A-2, A-4, A-6 material.	Seasonal high water table; moderate to high frost heave potential; seepage above fragipan; stones in places.	Seasonal high water table.	Fair to poor stability and compaction; fair resistance to piping; stones in places.
*Conestoga: CoB, CoC, CoD, CrB, CrD, CrF. For interpretations of Hollinger soils in units CrB, CrD, CtF, see the Hollinger series.	Good: stony phases poor.	Poor: good below a depth of 38 inches; saprolite for sand; no gravel.	Fair to good: mica content increases below a depth of 3 feet; A-2, A-4, A-5, A-6 material.	Micaceous substratum moderate to high frost heave potential; stones in places.	Pervious substratum.	Fair stability and compaction; fair to poor resistance to piping; erodible; stones in places.
Conotton: CtA, CtB, CtC, CtD, CtF.	Fair: gravelly	Good	Good: A-1, A-2, A-4 material.	Irregular topography in some areas.	Rapid permeability.	Fair stability; pervious when compacted; poor resistance to piping.
Duffield: DuA, DuB.	Good: fair below a depth of 10 inches.	Unsuitable: excessive fines.	Fair to poor: moderate shrink-swell potential; A-4, A-6 material.	Moderate to high frost heave potential; limestone bedrock at a depth of more than 5 feet; limestone ledges.	Moderate permeability; cavernous limestone bedrock.	Fair stability and compaction; fair resistance to piping; erodible.
Halsey: Ha	Poor: high water table; ponding.	Fair: good below a depth of 40 inches; excessive fines.	Poor: high water table; A-1, A-2, A-4, A-6 material.	High water table; moderate frost heave potential.	High water table; pervious substratum.	Fair stability; piping hazard.
Hollinger: HnB, HnC, HnD.	Fair: gravelly; stony phases poor.	Poor: good below a depth of 30 inches; saprolite for sand; no gravel.	Poor to fair: mica content increases with depth; A-4, A-5, A-6 material.	Micaceous substratum; moderate frost heave potential.	Pervious substratum.	Fair stability and compaction; poor resistance to piping; erodible.

selected engineering uses—Continued

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
High water table; slow permeability.	High water table; slow permeability; stones in places.	Slow permeability; stones in places.	High water table; moderate to low available moisture capacity; seepage above fragipan; stones in places.	High water table; susceptible to formation of frozen clods; stones in places.	High water table; high corrosion potential; stones in places.
Seasonal high water table; slow permeability.	Seasonal high water table; slow permeability; high available moisture capacity.	Slow permeability; poor stability.	Seasonal high water table; high available moisture capacity; poor stability.	Seasonal high water table; fair to poor trafficability; susceptible to formation of frozen clods.	Seasonal high water table.
Seasonal high water table; moderately slow permeability.	Seasonal high water table; moderately slow permeability; moderate available moisture capacity; stones in places.	Moderately slow permeability; stones in places.	Seasonal high water table; moderate available moisture capacity; seepage above fragipan; stones in places.	Seasonal high water table; poor trafficability; susceptible to formation of frozen clods; stones in places.	Seasonal high water table; seepage above fragipan; high corrosion potential; stones in places.
Well drained	Moderate permeability; high available moisture capacity; stones in places.	Fair stability; erodible; stones in places.	High available moisture capacity; fair stability; stones in places.	Fair trafficability; stones in places.	Stones in places; high corrosion potential.
Well drained	Rapid permeability; low available moisture capacity.	Fair stability; irregular topography in some areas.	Fair stability; irregular topography in some areas; low available moisture capacity.	Fair to good trafficability.	Subject to caving.
Well drained	Moderate permeability; high available moisture capacity.	Fair stability; limestone ledge in some places; erodible.	High available moisture capacity; limestone ledge in some places.	Fair to good trafficability; may form frozen clods.	High corrosion potential; limestone ledge in some places.
High water table; outlet limitations; ponding.	High water table; moderately slow permeability; ponding.	Moderately slow permeability; ponding.	High water table; moderate available moisture capacity; outlet limitations.	High water table; ponding.	High water table; subject to caving; ponding; high corrosion potential.
Well drained	Moderate permeability; moderate available moisture capacity.	Fair stability; erodible; stones in places.	Moderate available moisture capacity; fair stability; stones in places.	Fair trafficability; stones in places.	Bedrock ledge in some places; stones in places; high corrosion potential.

TABLE 6.—*Interpretations for*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir area	Embankment
Holly: Ho	Fair: high water table.	Generally unsuitable: fair in some places; high water table; excessive fines.	Fair to good: A-4, A-6 material.	High water table; moderate to high frost heave potential; flooding.	Flooding; pervious substratum.	Fair stability; piping hazard.
Laidig: LaB, LaD, LaF.	Poor: stony	Unsuitable: excessive fines.	Good: A-2, A-4 material.	Seepage above fragipan.	Occasional pervious substratum.	Fair stability; piping hazard; stony.
Middlebury: Mb	Good: seasonal high water table.	Generally unsuitable in some places; fair below a depth of 2 1/2 feet; excessive fines.	Fair: seasonal high water table; A-2, A-4 material.	Seasonal high water table; moderate frost heave potential; flooding.	Pervious substratum; flooding.	Fair to poor stability; poor resistance to piping.
Muck: Mu	Poor: high water table; organic material.	Unsuitable: excessive fines.	Unsuitable: high water table; high shrink-swell potential; organic material.	High water table; instability; organic material; ponding.	High water table; variable stability below water table; organic material; likely to float; possibly pervious substratum.	High water table; subsidence; organic material.
Phelps, thick solum variant: PhB.	Fair: seasonal high water table; gravelly.	Fair: seasonal high water table; excessive fines.	Good: seasonal high water table; A-2, A-4, A-6 material.	Seasonal high water table; moderate to high frost heave potential.	Pervious substratum.	Fair to poor stability; piping hazard.
Red Hook: Rh	Poor: seasonal high water table; gravelly.	Poor: seasonal high water table; fair below a depth of 3 feet.	Good: seasonal high water table; A-1, A-2, A-3, A-4 material.	Seasonal high water table; moderate frost heave potential.	Pervious substratum.	Fair stability and compaction; poor resistance to piping.
Rubble land: Ru	Unsuitable: stony.	Unsuitable: stony.	Poor: stony	Boulders	Pervious substratum.	Stony
Ryder: RyB, RyC	Good	Unsuitable: excessive fines.	Fair to poor: moderate shrink-swell potential; A-4, A-6 material.	Moderate to high frost heave potential; bedrock at a depth of 2 to 3 1/2 feet.	Limestone bedrock at a depth of 2 to 3 1/2 feet; possible sinks and solution channels.	Limited quantities; fair stability; erodible.
Stony land: St	Unsuitable: stony.	Unsuitable: stony.	Poor: stony	Stony	Pervious substratum.	Stony

selected engineering uses—Continued

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
High water table; flooding; outlet limitations.	High water table; flooding.	Fair stability	High water table; fair stability; outlet limitations.	High water table; fair to poor trafficability.	High water table; flooding; subject to caving; high corrosion potential.
Well drained	Moderately slow permeability; moderate available moisture capacity; stony.	Moderate slow permeability; stony.	Moderate available moisture capacity; stony.	Stony	Seepage above fragipan; stony; high corrosion potential.
Seasonal high water table; flooding; outlet limitations.	Seasonal high water table; moderate available moisture capacity; flooding.	Nearly level; sandy substratum within a depth of 3 feet; moderate permeability.	Seasonal high water table; moderate available moisture capacity; fair to poor stability.	Seasonal high water table; susceptible to formation of frozen clods.	Seasonal high water table; flooding; subject to caving.
High water table; outlet limitations; ponding.	High water table; ponding.	Ponding	High water table; outlet limitations; ponding.	High water table; high shrink-swell potential.	High water table; subsidence; high corrosion potential.
Seasonal high water table; moderately slow permeability.	Seasonal high water table; moderately slow permeability; moderate available moisture capacity.	Moderately slow permeability; fair to poor stability.	Seasonal high water table; moderate available moisture capacity; fair to poor stability.	Seasonal high water table.	Seasonal high water table.
Seasonal high water table; outlet limitations.	Seasonal high water table; moderately slow permeability; moderate available moisture capacity.	Moderately slow permeability; nearly level; outlet limitations.	Seasonal high water table; moderate available moisture capacity; outlet limitations.	Seasonal high water table.	Seasonal high water table; subject to caving; high corrosion potential.
Stony	Stony	Stony	Stony	Poor trafficability.	Stony and ledgy.
Well drained	Moderate permeability; moderate available moisture capacity; bedrock at a depth of 2 to 3 1/2 feet.	Limestone bedrock at a depth of 2 to 3 1/2 feet; erodible.	Moderate available moisture capacity; fair stability; limestone bedrock at a depth of 2 to 3 1/2 feet.	Susceptible to formation of frozen clods.	Bedrock at a depth of 2 to 3 1/2 feet.
Stony	Stony	Stony	Stony	Poor trafficability.	Stony and ledgy.

TABLE 6.—*Interpretations for*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir area	Embankment
*Swartswood: SvB, SvC, SvD, SwB, SwD. For interpretations of Wurtsboro soils in the units SwB and SwD, see Wurtsboro series.	Fair: gravelly; stony phases poor.	Unsuitable: excessive fines.	Good: contains some stone; A-1, A-2, A-4 material.	Seepage above fragipan; stones in places.	Pervious substratum.	Fair to poor stability; poor resistance to piping; stones in places.
Urban land: UrA, UrC, Us. Requires onsite investigation.						
Urbana: UtB	Fair: seasonal high water table.	Generally unsuitable: in some places fair below a depth of 30 inches; seasonal high water table; saprolite for sand; no gravel.	Fair to poor: seasonal high water table; A-4 material.	Seasonal high water table; high frost heave potential.	Seasonal high water table; pervious substratum.	Fair stability; fair to good compaction; fair resistance to piping.
Volusia: VoB, VuB.	Fair: gravelly; stony phases poor.	Unsuitable: excessive fines.	Fair to good: seasonal high water table; A-4 material.	Seasonal high water table; moderate frost heave potential; seepage above fragipan; stones in places.	Seasonal high water table.	Fair stability; piping hazard; stones in places.
Washington: WaA, WaB, WaC, WaC3, WaD, WhF.	Good	Unsuitable: excessive fines.	Fair to poor: A-2, A-4, A-6, A-7 material.	Moderate to high frost heave potential; possible sink holes and limestone ledges.	Moderate permeability; possible sinks and solution channels.	Fair stability and compaction; piping hazard; erodible.
Weikert: WkB, WkC, WkD.	Poor: channery; bedrock at a depth of 1 to 1 1/2 feet.	Unsuitable: excessive fines.	Fair to good: bedrock at a depth of 1 to 1 1/2 feet; A-1, A-2, A-4 material.	Weathered shale, silt stone, and thin bedded sandstone bedrock at a depth of less than 20 inches.	Pervious bedrock at a depth of less than 20 inches.	Fair to poor stability; piping hazard; permeable bedrock at a depth of less than 20 inches.
Wurtsboro: WuB, WuC.	Fair: gravelly; stony phases poor.	Unsuitable: excessive fines.	Good: contains some stones; A-2, A-4 material.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; pervious substratum.	Fair stability; piping hazard; stones in places.

selected engineering uses—Continued

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Fragipan at a depth of 18 to 30 inches.	Moderate permeability; low available moisture capacity.	Moderate permeability; fair to poor stability; stones in places.	Low available moisture capacity; fair to poor stability.	Susceptible to formation of frozen clods.	Seepage above fragipan; stones in places; high corrosion potential.
Seasonal high water table; moderately slow permeability.	Seasonal high water table; moderately slow permeability; moderate available moisture capacity.	Moderately slow permeability; fair stability.	Seasonal high water table; moderate available moisture capacity.	Seasonal high water table; fair to poor trafficability.	Seasonal high water table; seepage above fragipan; high corrosion potential.
Seasonal high water table; slow permeability.	Seasonal high water table; slow permeability; low available moisture capacity.	Slow permeability; fair stability; stones in places.	Seasonal high water table; low available moisture capacity; seepage above fragipan.	Seasonal high water table; susceptible to formation of frozen clods.	Seasonal high water table; seepage above fragipan; stones in places; high corrosion potential.
Well drained_____	Moderate permeability; high available moisture capacity.	Uneven topography: outlet limitations; limestone ledge in some places; erodible.	Fair stability; limestone ledge in some places; high available moisture capacity.	Fair trafficability.	Limestone ledge in some places.
Well drained_____	Low available moisture capacity; bedrock at a depth of less than 20 inches.	Fractured shale bedrock at a depth of less than 20 inches.	Low available moisture capacity; fair to poor stability; fractured bedrock at a depth of less than 20 inches.	Fair compaction___	Fractured bedrock at a depth of less than 20 inches.
Seasonal high water table; moderately slow permeability.	Seasonal high water table; moderately slow permeability; low available moisture capacity.	Moderately slow permeability; fair stability; stones in places.	Seasonal high water table; low available moisture capacity; fair stability.	Seasonal high water table; susceptible to formation of frozen clods.	Seasonal high water table; dry; seepage above fragipan; stones in places; high corrosion potential.

TABLE 7.—*Soil limitations for uses related to town and country planning*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basements	Lawns and landscaping	Streets and parking lots for subdivisions	Sanitary landfills[1/]	Cemeteries
Alluvial land: Ad.	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding; variable textured surface layer.	Severe: flooding	Severe: flooding	Severe: flooding
Andover: AnA_____	Severe: high water table; slow permeability.	Slight___	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
AnB_____	Severe: high water table; slow permeability.	Moderate: slope.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
AoB_____	Severe: high water table; slow permeability; stones.	Moderate: slope; stones.	Severe: high water table; stones.	Severe: high water table; stones.	Severe: high water table.	Severe: high water table; stones.	Severe: high water table; stones.
Baile, neutral variant: BaB_____	Severe: high water table; slow permeability.	Moderate; slope.	Severe: high water table;	Severe: high water table.	Severe high water table.	Severe: high water table.	Severe: high water table.
BeB_____	Severe: high water table; slow permeability; stones.	Moderate: slope; stones.	Severe: high water table; stones.	Severe: high water table; stones.	Severe: high water table.	Severe: high water table; stones.	Severe: high water table; stones.
Barbour: Bg_____	Severe: flooding	Severe: flooding; moderately rapid permeability.	Severe: flooding.	Moderate: flooding	Severe: flooding	Severe: flooding	Severe: flooding.
Bm_____ Interpretations for Bm apply to Middlebury part of unit as well as to Barbour part.	Moderate: flooding.	Severe: moderately rapid permeability; flooding.	Moderate: flooding.	Moderate; sandy loam surface layer.	Moderate: flooding.	Moderate: flooding.	Moderate: flooding; sandy loam surface layer.
Bedington: BnA_____	Moderate: moderate permeability.	Severe: moderately rapid permeability in substratum.	Slight_____	Slight_____	Slight_____	Slight____	Slight.

TABLE 7.—*Soil limitations for uses related to town and country planning—Continued*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basements	Lawns and landscaping	Streets and parking lots for subdivisions	Sanitary landfills[1/]	Cemeteries
BoB_____	Moderate: moderate permeability.	Severe: moderately rapid permeability in substratum.	Slight_____	Slight_____	Moderate: slope.	Slight_____	Slight____
BoC_____	Moderate: slope; moderate permeability.	Severe: slope; moderately rapid permeability in substratum.	Moderate: slope__	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
BpB_____	Severe: stones.	Severe: moderately rapid permeability in substratum; stones.	Severe: stones	Severe: stones.	Moderate: slope; stones.	Severe: stones.	Severe: stones.
Berks:							
BrA_____	Severe: 1 1/2 to 3 1/2 feet to bedrock; hazard of ground water contamination.	Severe: moderately rapid permeability; hazard of ground water contamination.	Moderate: 1 1/2 to 3 1/2 feet to bedrock.	Moderate: 1 1/2 to 3 1/2 feet to bedrock.	Moderate: 1 1/2 to 3 1/2 feet to bedrock.	Severe: moderately rapid permeability;, 1 1/2 to 3 1/2 feet to bedrock.	Moderate: 1 1/2 to 3 1/2 feet to bedrock.
BrB_____	Severe: 1 1/2 to 3 1/2 feet to bedrock; hazard of ground water contamination.	Severe: moderately rapid permeability; hazard of ground water contamination.	Moderate: 1 1/2 to 3 1/2 feet to bedrock.	Slight____	Moderate: 1 1/2 to 3 1/2 feet to bedrock.	Severe: moderately rapid permeability 1 1/2 to 3 1/2 feet to bedrock.	Moderate: 1 1/2 to 3 1/2 feet to bedrock.
BrC_____	Severe: 1 1/2 to 3 1/2 feet to bedrock; hazard of ground water contamination.	Severe: moderately rapid permeability; hazard of ground water contamination.	Moderate: 1 1/2 to 3 1/2 feet to bedrock.	Moderate: slope.	Severe: slope.	Severe: moderately rapid permeability 1 1/2 to 3 1/2 feet to bedrock.	Moderate: 1 1/2 to 3 1/2 feet to bedrock.
BrD_____	Severe: slope, 1 1/2 to 3 1/2 feet to bedrock; hazard of ground water contamination.	Severe: slope; moderately rapid permeability; hazard of ground water contamination.	Severe: slope	Severe: slope.	Severe: slope.	Severe: moderately rapid permeability.	Severe: slope.

TABLE 7.—*Soil limitations for uses related to town and country planning—Continued*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basements	Lawns and landscaping	Streets and parking lots for subdivisions	Sanitary landfills[1/]	Cemeteries
BsF_____ Interpretations for BsF apply to Weikert part of unit as well as to Berks part.	Severe: slope, 1 1/2 to 3 1/2 feet to bedrock; hazard of ground water contamination.	Severe: slope; moderately rapid permeability; hazard of ground water contamination.	Severe: slope____	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Brinkerton:							
BtA_____	Severe: high water table slow permeability.	Slight__	Severe: high water table.	Severe: high water table.	Severe: high water table	Severe: high water table.	Severe: high water table.
BtB_____	Severe: high water table; slow permeability.	Moderate: slope.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Buchanan:							
BuB_____	Severe: slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Severe: seasonal high water table.
BvB_____	Severe: slow permeability; stones; seasonal high water table.	Moderate: slope; stones.	Severe: stones; seasonal high water table.	Severe: stones.	Moderate: stones; seasonal high water table; slope.	Severe: stones; seasonal high water table.	Severe: stones; seasonal high water table.
Chippewa:							
ChA_____	Severe: high water table; slow permeability.	Slight: inflow hazard.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
ChB_____	Severe: high water table; slow permeability.	Moderate: slope; inflow hazard.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
CkB_____	Severe: high water table; slow permeability; stones.	Moderate: slope; inflow hazard; stones.	Severe: high water table; stones.	Severe; high water table; stones.	Severe: high water table.	Severe: high water table. stones.	Severe: high water table; stones.
Clarksburg:							
ClA_____	Severe: slow permeability.	Slight__	Moderate: seasonal high water table.	Slight_____	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate. seasonal high water table.
ClB_____	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Slight_____	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table.

TABLE 7.—*Soil limitations for uses related to town and country planning—Continued*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basements	Lawns and landscaping	Streets and parking lots for subdivisions	Sanitary landfills[1/]	Cemeteries
Comly: CmA	Severe: seasonal high water table; moderately slow permeability.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.
CmB	Severe: moderately slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Severe: seasonal high table.
CnB	Severe: moderately slow permeability; seasonal high water table; stones.	Moderate: stones, slope.	Severe: seasonal high water table; stones.	Severe: stones.	Moderate: seasonal high water table; stones; slope.	Severe: stones.	Severe: seasonal high water table; stones.
Conestoga: CoB	Slight	Severe: moderately rapid permeability in substratum.	Slight	Slight	Moderate: slope.	Slight	Slight.
CoC	Moderate: slope.	Severe: slope; moderately rapid permeability in substratum.	Moderate: slope	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CoD	Severe: slope.	Severe: slope; moderately rapid permeability in substratum.	Severe: slope	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
CrB	Severe: stones.	Severe: moderately rapid permeability in substratum.	Severe: stones.	Severe: stones.	Moderate: stones; slope.	Severe: stones.	Severe: stones.
CrD, CrF—Interpretations for CrB, Crd, and CrF apply to Hollinger part of units as well as to Conestoga part.	Severe: slope; stones.	Severe: slope; moderately rapid permeability in substratum.	Severe: slope; stones.	Severe: slope; stones.	Severe: slope.	Severe: slope; stones.	Severe: slope; stones.

TABLE 7.—*Soil limitations for uses related to town and country planning—Continued*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basements	Lawns and landscaping	Streets and parking lots for subdivisions	Sanitary landfills 1/	Cemeteries
Conotton: CtA	Slight: hazard of ground water contamination.	Severe: rapid permeability; hazard of ground water contamination.	Slight	Slight	Slight	Severe: rapid permeability; hazard of ground water contamination.	Slight.
CtB	Slight: hazard of ground water contamination.	Severe: rapid permeability, hazard of ground water contamination.	Slight	Slight	Moderate: slope.	Severe: rapid permeability; hazard of ground water contamination.	Slight.
CtC	Moderate: slope; hazard of ground water contamination.	Severe: slope, rapid permeability; hazard of ground water contamination.	Moderate: slope	Moderate: slope.	Severe: slope.	Severe: rapid permeability; hazard of ground water contamination.	Moderate: slope.
CtD	Severe: slope; hazard of ground water contamination.	Severe: slope, hazard of ground water contamination.	Severe: slope	Severe: slope.	Severe: slope.	Severe: rapid permeability; hazard of ground water contamination.	Severe: slope.
CtF	Severe: slope; hazard of ground water contamination.	Severe: slope; hazard of ground water contamination.	Severe: slope	Severe: slope	Severe: slope.	Severe: slope; hazard of ground water contamination.	Severe: slope.
Duffield: DuA	Slight: hazard of ground water contamination.	Moderate: moderate permeability; hazard of ground water contamination.	Slight	Slight	Slight	Slight: hazard of ground water contamination.	Slight.
DuB	Slight: hazard of ground water contamination.	Moderate: moderate permeability; slope; hazard of ground water contamination.	Slight	Slight	Moderate: slope.	Slight: hazard of ground water contamination.	Slight.

TABLE 7.—*Soil limitations for uses related to town and country planning—Continued*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basements	Lawns and landscaping	Streets and parking lots for subdivisions	Sanitary landfills[1/]	Cemeteries
Halsey: Ha__	Severe: high water table; moderately slow permeability	Severe: rapid permeability in substratum.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Hollinger: HnB_____	Slight_____	Moderate: moderate permeability; slope.	Slight_____	Slight_____	Moderate: slope.	Slight_____	Slight.
HnC_____	Moderate: slope.	Severe: slope.	Moderate: slope__	Moderate: slope.	Severe: slope.	Slight_____	Moderate: slope.
HnD_____	Severe: slope.	Severe: slope.	Severe: slope____	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Holly: Ho___	Severe: high water table; flooding.	Severe: flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Laidig: LaB_____	Severe: moderately slow permeability; stones.	Moderate: slope; stones.	Severe: stones___	Severe: stones.	Moderate: slope; stones.	Severe: stones.	Severe: stones.
LaD, LaF___	Severe: moderately slow permeability; slope; stones.	Severe: slope.	Severe: slope; stones.	Severe: slope; stones.	Severe: slope.	Severe: slope; stones.	Severe: slope; stones.
Middlebury: Mb_____	Severe: flooding; seasonal high water table.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Muck: Mu_____	Severe: high water table; flooding.	Severe: organic matter; inflow hazard.	Severe: high water table.	Severe: high water table ponding.	Severe: high water table ponding.	Severe: high water table ponding.	Severe: high water table; ponding.
Phelps, thick solum variant: PhB_____	Severe: moderately slow permeability.	Severe: rapid permeability in substratum.	Moderate: seasonal high water table.	Slight_____	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
Red Hook: Rh_____	Severe: seasonal high water table; moderately slow permeability.	Severe: rapid permeability in substratum.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.
Rubble land: Ru_____	Severe: stones, slope.	Severe: stones; slope.	Severe: stones, slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.

TABLE 7.—*Soil limitations for uses related to town and country planning—Continued*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basement	lawns and landscaping	Streets and parking lots for sub-divisions	Sanitary landfills[1/]	Cemeteries
Ryder: RyB_____	Severe: 2 to 3 1/3 feet to bedrock.	Severe: 2 to 3 1/2 feet to bedrock.	Moderate: 2 to 3 1/2 feet to bedrock.	Moderate: 2 to 3 1/2 feet to bedrock.	Moderate: 2 to 3 1/2 feet to bedrock; slope.	Severe: 2 to 3 1/2 feet to bedrock.	Moderate: 2 to 3 1/2 feet to bedrock.
RyC_____	Severe: 2 to 3 1/2 feet to bedrock.	Severe: 2 to 3 1/2 feet to bedrock.	Moderate: slope; 2 to 3 1/2 feet to bedrock.	Moderate: slope; 2 to 3 1/2 feet to bedrock.	Severe: slope.	Severe: 2 to 3 1/2 feet to bedrock; slope.	Moderate: 2 to 3 1/2 feet to bedrock; slope.
Stony land: St_____	Severe: slope; stones	Severe: slope; stones.	Severe: slope; stones.	Severe: slope; stones.	Severe: slope; stones.	Severe: slope; stones.	Severe: slope; stones.
Swartswood: SvB_____	Slight_____	Moderate: slope.	Slight_____	Slight____	Moderate: slope.	Slight_____	Slight.
SvC_____	Moderate: slope.	Severe: slope.	Moderate: slope__	Moderate: slope.	Severe: slope.	Slight_____	Moderate: slope.
SvD_____	Severe: slope.	Severe: slope.	Severe: slope____	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
SwB_____	Severe: stones; moderately slow permeability.	Moderate: slope; stones.	Severe: stones___	Severe: stones.	Moderate: stones, seasonal high water table; slope.	Severe: stones.	Severe: stones.
SwD_____ Interpretations for SwB and SwD apply to Wurtsboro part of units as well as to Swartswood parts.	Severe: stones; moderately slow permeability; slope.	Severe: slope.	Severe: slope; stones.	Severe: slope; stones.	Severe: slope.	Severe: stones, slope.	Severe: slope; stones.
Urban land: UrA_____	Variable: seasonal high water table; moderately slow permeability; hazard of ground water contamination.	Variable: hazard of ground water contamination.	Variable: seasonal high water table.	Variable: seasonal high water table.	Variable: seasonal high water table; slope.	Variable: seasonal high water table; hazard of ground water contamination.	Variable: seasonal high water table.
UrC_____	Severe: slope.	Severe: slope.	Severe: slope____	Severe: slope.	Severe: slope.	Variable: seasonal high water table.	Severe: slope.
Us_____	Severe: flooding.	Severe: flooding.	Severe: flooding.	Variable: flooding.	Variable: flooding; seasonal high water table	Severe: flooding.	Severe: flooding.

TABLE 7.—*Soil limitations for uses related to town and country planning—Continued*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basement	Lawns and landscaping	Streets and parking lots for subdivisions	Sanitary landfills[1/]	Cemeteries
Urbana: UtB__	Severe: moderately slow permeability	Moderate: slope.	Moderate: seasonal high water table.	Slight_____	Moderate: slope; seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
Volusia: VoB_____	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.
VuB_____	Severe: seasonal high water table; slow permeability, stones.	Moderate: slope; stones.	Severe: seasonal high water table, stones.	Severe: stones.	Moderate: seasonal high water table; slope; stones.	Severe: stones.	Severe: seasonal high water table; stones.
Washington: WaA_____	Slight: hazard of ground water contamination.	Moderate: moderate permeability; hazard of ground water contamination.	Slight_____	Slight____	Slight_____	Moderate: moderately fine textured subsoil; hazard of ground water contamination.	Slight.
WaB_____	Slight: hazard of ground water contamination.	Moderate: slope; moderate permeability, hazard of ground water contamination.	Slight_____	Slight_____	Moderate: slope.	Moderate: moderately fine textured subsoil; hazard of ground water contamination.	Slight.
WaC_____	Moderate: slope; hazard of ground water contamination.	Severe: slope, hazard of ground water contamination.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: moderately fine textured subsoil; hazard of ground water contamination.	Moderate: slope.
WaC3_____	Moderate: slope; hazard of ground water contamination.	Severe: slope; hazard of ground water contamination.	Moderate: slope.	Severe: eroded.	Severe: slope.	Moderate: moderately fine textured subsoil; hazard of ground water contamination.	Severe: eroded.
WaD_____	Severe: slope; hazard of ground water contamination.	Severe: slope; hazard of ground water contamination.	Severe: slope____	Severe: slope.	Severe: slope.	Moderate: moderately fine textured subsoil; hazard of ground water contamination.	Severe: slope.

TABLE 7.—*Soil limitations for uses related to town and country planning—Continued*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Homes of three stories or less, with basement	Lawns and landscaping	Streets and parking lots for subdivisions	Sanitary landfills[1/]	Cemeteries
WhF_____	Severe: slope; hazard of ground water contamination.	Severe: slope; hazard of ground water contamination.	Severe: slope, rocks.	Severe: slope; rocks.	Severe: slope; rocks.	Severe: slope; hazard of ground water contamination; rocks.	Severe: slope; rocks.
Weikert:							
WkB_____	Severe: 1 to 1 1/2 feet to bedrock; hazard of ground water contamination.	Severe: 1 to 1 1/2 feet to bedrock; moderately rapid permeability; hazard of ground water contamination.	Moderate: 1 to 1 1/2 feet to bedrock.	Moderate: 1 to 1 1/2 feet to bedrock.	Moderate: 1 to 1 1/2 feet to bedrock; slope.	Severe: 1 to 1 1/2 feet to bedrock; hazard of ground water contamination.	Moderate: 1 to 1 1/2 feet to bedrock.
WkC_____	Severe: 1 to 1 1/2 feet to bedrock; hazard of ground water contamination.	Severe: 1 to 1 1/2 feet to bedrock; moderately rapid permeability; hazard of ground water contamination; slope.	Moderate: 1 to 1 1/2 feet to bedrock; slope.	Moderate: 1 to 1 1/2 feet to bedrock; slope.	Severe: slope.	Severe: 1 to 1 1/2 feet to bedrock; slope; hazard of ground water contamination.	Moderate: 1 to 1 1/2 feet to bedrock; slope.
WkD_____	Severe: slope, 1 to 1 1/2 feet to bedrock; hazard of ground water contamination.	Severe: slope, 1 to 1 1/2 feet to bedrock; hazard of ground water contamination; moderately rapid permeability.	Severe: slope____	Severe: slope.	Severe: slope.	Severe: 1 to 1 1/2 feet to bedrock; hazard of ground water contamination.	Severe: slope.
Wurtsboro:							
WuB_____	Severe: moderately slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Slight____	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
WuC_____	Severe: moderately slow permeability.	Severe: slope.	Moderate: seasonal high water table; slope.	Moderate: slope.	Severe: slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.

[1/] Onsite studies of the underlying strata, water tables, and hazards of aquifer pollution into ground water need to be made for landfills deeper than 5 or 6 feet.

TABLE 8.—*Soil limitations for recreational development*

Soil series and map symbols	Campsites		Service buildings in recreational areas (without basements)	Paths and trails in camping areas	Picnic and play areas (extensively used)	Athletic fields (extensively used)	Golf fairways
	Tents	Trailers					
Alluvial land: Ad	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Andover: AnA	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
AnB	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
AoB	Severe: high water table; stones.	Severe: high water table; stones.	Severe: high water table.	Severe: high water table; stones.	Severe: high water table.	Severe: high water table; stones.	Severe: high water table; stones.
Baile, neutral variant: BaB	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
BeB	Severe: high water table; stones	Severe: high water table; stones.	Severe: high water table.	Severe: high water table; stones.	Severe: high water table.	Severe: high water table; stones.	Severe: high water table; stones.
Barbour: Bg	Moderate: flooding.	Moderate: flooding.	Severe: flooding.	Slight	Moderate: flooding.	Moderate: flooding.	Moderate: flooding.
Bm	Slight	Slight	Moderate: flooding.	Slight	Slight	Slight	Moderate: sandy loam surface layer.
Interpretations for Bm apply to Middlebury part of unit as well as to Barbour part.							
Bedington: BnA	Slight	Slight	Slight	Slight	Slight	Slight	Slight.
BoB	Moderate: shaly.	Moderate: shaly, slope.	Slight	Moderate: shaly.	Moderate: shaly.	Severe: shaly.	Moderate: shaly.
BoC	Moderate: slope; shaly.	Severe: slope.	Moderate: slope.	Moderate: shaly.	Moderate: slope; shaly.	Severe: slope; shaly.	Moderate: slope; shaly.
BpB	Severe: stones.	Severe: stones.	Moderate: stones.	Severe: stones.	Moderate: stones.	Severe: stones.	Severe: stones.
Berks: BrA	Moderate: shaly.	Moderate: shaly.	Slight	Moderate: shaly.	Moderate: shaly.	Severe: shaly.	Moderate: 1 1/2 to 3 1/2 feet to bedrock; shaly.
BrB	Moderate: shaly.	Moderate: shaly; slope.	Slight	Moderate: shaly.	Moderate: shaly.	Severe: shaly.	Moderate: 1 1/2 to 3 1/2 feet to bedrock; shaly.

TABLE 8.—*Soil limitations for recreational developments—Continued*

Soil series and map symbols	Campsites		Service buildings in recreational areas (without basements)	Paths and trails in camping areas	Picnic and play areas extensively used)	Athletic fields (extensively used)	Golf fairways
	Tents	Trailers					
BrC----------	Moderate: shaly; slope.	Severe: slope.	Moderate: slope.	Moderate: shaly.	Moderate: slope; shaly.	Severe: slope; shaly.	Moderate: slope, 1 1/2 to 3 1/2 feet to bedrock; shaly.
BrD----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope; shaly.	Severe: slope.	Severe: slope; shaly.	Severe: slope.
BsF---------- Interpretations for BsF apply to Weikert part of unit as well as to Berks part.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Brinkerton:							
BtA----------	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
BtB----------	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Buchanan:							
BuB----------	Moderate: seasonal high water table; slow permeability; gravelly.	Moderate: seasonal high water table; slow permeability; gravelly; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table; gravelly.	Moderate: seasonal high water table; gravelly.	Severe: gravelly.	Moderate: seasonal high water table; gravelly.
BvB----------	Severe: stony.	Severe: stones.	Moderate: stones; seasonal high water table.	Severe: stones.	Moderate: stones, seasonal high water table.	Severe: stones; gravelly.	Severe: stones.
Chippewa:							
ChA, ChB-----	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
CkB----------	Severe: high water table; stones.	Severe: high water table stones.	Severe: high water table.	Severe: high water table; stones.	Severe: high water table.	Severe: high water table; stones.	Severe: high water table; stones.
Clarksburg:							
ClA----------	Moderate: slow permeability.	Moderate: slow permeability.	Slight--------	Slight-------	Slight-------	Moderate: seasonal high water table; slow permeability.	Slight.
ClB----------	Moderate: slow permeability.	Moderate: slow permeability; slope.	Slight--------	Slight-------	Slight-------	Moderate: seasonal high water table; slope; slow permeability.	Slight.

TABLE 8.—*Soil limitations for recreational developments—Continued*

Soil series and map symbols	Campsites		Service buildings in recreational areas (without basements)	Paths and trails in camping areas	Picnic and play areas (extensively used)	Athletic fields (extensively used)	Golf fairways
	Tents	Trailers					
Comly:							
CmA	Moderate: moderately slow permeability; seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
CmB	Moderate: moderately slow permeability; seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
CnB	Severe: stones.	Severe: stones.	Moderate: seasonal high water table; stones.	Severe: stones.	Moderate; seasonal high water table; stones.	Severe: seasonal high water table; stones.	Severe: stones.
Conestoga:							
CoB	Slight	Moderate: slope.	Slight	Slight	Slight	Moderate: slope.	Slight.
CoC	Moderate: slope.	Severe: slope.	Moderate: slope.	Slight	Moderate: slope.	Severe: slope.	Moderate: slope.
CoD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate slope.	Severe: slope.	Severe: slope.	Severe: slope.
CrB	Severe: stones.	Severe: stones.	Moderate: stones.	Severe: stones.	Moderate: stones.	Severe: stones.	Severe: stones.
CrD	Severe: slope; stones.	Severe: slope; stones.	Severe: slope.	Severe: stones.	Severe: slope.	Severe: slope; stones.	Severe: slope; stones.
CrF Interpretations for CrB, CrD, and CrF apply to Hollinger part of units as well as to Conestoga part.	Severe: slope; stones.	Severe: slope; stones.	Severe: slope.	Severe: slope; stones.	Severe: slope.	Severe: slope; stones.	Severe: slope; stones.
Conotton:							
CtA	Moderate; gravelly.	Moderate: gravelly.	Slight	Moderate: gravelly.	Moderate: gravelly.	Severe: gravelly.	Moderate: gravelly.
CtB	Moderate: gravelly.	Moderate: gravelly; slope.	Slight	Moderate: gravelly.	Moderate: gravelly.	Severe: gravelly.	Moderate: gravelly.
CtC	Moderate: gravelly; slope.	Severe: slope.	Moderate: slope.	Moderate: gravelly.	Moderate: gravelly; slope.	Severe: gravelly; slope.	Moderate: gravelly; slope.
CtD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope; gravelly.	Severe: slope.	Severe: slope; gravelly.	Severe: slope.

TABLE 8.—*Soil limitations for recreational developments—Continued*

Soil series and map symbols	Campsites		Service buildings in recreational areas (without basements)	Paths and trails in camping areas	Picnic and play areas (extensively used)	Athletic fields (extensively used)	Golf fairways
	Tents	Trailers					
CtF	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope; gravelly.	Severe: slope.
Duffield:							
DuA	Slight	Slight	Slight	Slight	Slight	Slight	Slight.
DuB	Slight	Moderate: slope.	Slight	Slight	Slight	Moderate: slope.	Slight.
Halsey: Ha	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Hollinger:							
HnB	Moderate: gravelly.	Moderate: gravelly; slope.	Slight	Moderate: gravelly.	Moderate: gravelly.	Severe: gravelly.	Moderate: gravelly.
HnC	Moderate: gravelly; slope.	Severe: slope.	Moderate: slope.	Moderate: gravelly.	Moderate: gravelly; slope.	Severe: gravelly; slope.	Moderate: gravelly slope.
HnD	Severe: slope.	Severe: slope.	Severe: slope	Moderate: slope; gravelly.	Severe: slope.	Severe: slope; gravelly.	Severe: slope.
Holly: Ho	Severe: high water table.	Severe: high water table.	Severe: high water table; flooding.	Severe: high water water table.	Severe: high water table.	Severe: high water table.	Severe: high water table; flooding.
Laidig:							
LaB	Severe: stones.	Severe: stones.	Moderate: stones.	Severe: stones.	Moderate: stones.	Severe: stones.	Severe: stones.
LaD, LaF	Severe: slope; stones.	Severe: slope; stones	Severe: slope.	Severe: stones.	Severe: slope.	Severe: slope; stones.	Severe: slope; stones.
Middlebury: Mb	Moderate: flooding; seasonal high water table.	Moderate: flooding; seasonal high water table.	Severe: flooding.	Moderate: seasonal high water table.	Moderate: flooding; seasonal high water table.	Severe: seasonal high water table.	Moderate: flooding; seasonal high water table.
Muck: Mu	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Phelps, thick solum variant: PhB	Moderate: moderately slow permeability; gravelly.	Moderate: moderately slow permeability; gravelly; slope.	Slight	Moderate: gravelly.	Moderate: gravelly.	Severe: gravelly.	Moderate: gravelly.
Red Hook: Rh	Moderate: seasonal high water table; gravelly.	Moderate: seasonal high water table; gravelly.	Moderate: seasonal high water table.	Moderate: seasonal high water table; gravelly.	Moderate: seasonal high water table; gravelly.	Severe: seasonal high water table; gravelly.	Moderate: seasonal high water table; gravelly.
Rubble land: Ru	Severe: stones slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.

TABLE 8.—*Soil limitations for recreational development—Continued*

Soil series and map symbols	Campsites		Service buildings in recreational areas (without basements)	Paths and trails in camping areas	Picnic and play areas (extensively used)	Athletic fields (extensively used)	Golf fairways
	Tents	Trailers					
Ryder: RyB	Slight	Moderate: slope.	Slight	Slight	Slight	Moderate: 2 to 3 1/2 feet to bedrock; slope.	Moderate: 2 to 3 1/2 feet to bedrock.
RyC	Moderate: slope.	Severe: slope.	Moderate: slope.	Slight	Moderate: slope.	Severe: slope.	Moderate: 2 to 3 1/2 feet to bedrock; slope.
Stony land: St	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.	Severe: stones; slope.
Swartswood: SvB	Moderate: gravelly.	Moderate: slope; gravelly.	Slight	Moderate: gravelly.	Moderate: gravelly.	Severe: gravelly.	Moderate: gravelly.
SvC	Moderate: gravelly; slope.	Severe: slope.	Moderate: slope.	Moderate: gravelly.	Moderate: gravelly; slopes.	Severe: gravelly; slope.	Moderate: gravelly.
SvD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope; gravelly.	Severe: slope.	Severe: slope; gravelly.	Severe: slope.
SwB	Severe: stones.	Severe: stones.	Moderate: stones.	Severe: stones.	Moderate: stones.	Severe: stones.	Severe: stones.
SwD Interpretations for SwB and SwD apply to Wurtsboro part of units as well as to Swartswood part.	Severe: slope; stones.	Severe: slope; stones.	Severe: slope.	Severe: stones.	Severe: slope.	Severe: slope; stones.	Severe: slope; stones.
Urban Land: UrA	Variable: seasonal high water table; shaly.	Variable: seasonal high water table; shaly.	Slight	Slight	Variable: seasonal high water table; shaly.	Variable: seasonal high water table; shaly.	Variable: seasonal high water table; shaly.
UrC	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Us	Variable: seasonal high water table; flooding; shaly.	Variable: seasonal high water table; flooding; shaly.	Variable: flooding.	Variable: seasonal high water table; shaly.	Variable seasonal high water table; flooding; shaly.	Variable: seasonal high water table; flooding; shaly.	Variable: seasonal high water table; flooding; shaly.
Urbana: UtB	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Slight	Slight	Moderate: seasonal high water table; slope.	Slight.

TABLE 8—*Soil limitations for recreational developments—Continued*

Soil series and map symbols	Campsites		Service buildings in recreational areas (without basements)	Paths and trails in camping areas	Picnic and play areas (extensively used)	Athletic fields (extensively used)	Golf fairways
	Tents	Trailers					
Volusia:							
VoB	Moderate: seasonal high water table; slow permeability; gravelly.	Moderate: seasonal high water table; slow permeability; gravelly; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table; gravelly.	Moderate: seasonal high water table; gravelly.	Severe: seasonal high water table; gravelly.	Moderate: seasonal high water table.
VuB	Severe: stones.	Severe: stones.	Moderate: stones; seasonal high water table.	Severe: stones.	Moderate: seasonal high water table; stones; gravelly.	Severe: seasonal high water table; gravelly; stones.	Severe: stones.
Washington:							
WaA	Slight	Slight	Slight	Slight	Slight	Slight	Slight.
WaB	Slight	Moderate: slope.	Slight	Slight	Slight	Moderate: slope.	Slight.
WaC	Moderate: slope.	Severe: slope.	Moderate: slope.	Slight	Moderate: slope.	Severe: slope.	Moderate: slope.
WaC3	Moderate: slope.	Severe: slope.	Moderate: slope.	Slight	Moderate: slope.	Severe: slope.	Severe: eroded.
WaD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WhF	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope; rocks.	Severe: slope; rocks.
Weikert:							
WkB	Moderate: channery.	Moderate: channery; slope.	Moderate: 1 to 1 1/2 feet to bedrock.	Moderate: channery.	Moderate: channery.	Severe: 1 to 1 1/2 feet to bedrock; channery.	Severe: 1 to 1 1/2 feet to bedrock.
WkC	Moderate: channery; slope.	Severe: slope.	Moderate: slope; 1 to 1 1/2 feet to bedrock.	Moderate: channery.	Moderate: channery; slope.	Severe: channery; slope; 1 to 1 1/2 feet to bedrock.	Severe: 1 to 1 1/2 feet to bedrock; channery; slope.
WkD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope; channery.	Severe: slope.	Severe: slope; channery.	Severe: slope.
Wurtsboro:							
WuB	Moderate: moderately slow permeability; gravelly.	Moderate: moderately slow permeability.	Slight	Moderate: gravelly.	Moderate: gravelly.	Severe: gravelly.	Moderate: gravelly.
WuC	Moderate: moderately slow permeability; slope; gravelly.	Severe: slope.	Moderate: slope.	Moderate: gravelly.	Moderate: slope; gravelly.	Severe: slope; gravelly.	Moderate: slope; gravelly.

Descriptions of the Soils

This section describes the soil series and mapping units in Northampton County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors and consistence given in the descriptions are those of a moist soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Rubble land, for example, does not belong to a soil series, but nevertheless is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit in which the mapping unit has been placed. The page on which the capability unit is described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 9. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*21*).

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this county are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

Alluvial Land

Alluvial land, coal overwash (Ad) is the only phase of Alluvial land in Northampton County. This miscellaneous land type consists of alluvium that has an overlayer of more than 10 inches of dark-colored carbonaceous sediment derived from coal washings. The underlying soil material is of varying nature; consequently, variations in natural drainage and in depth to seasonal high water table are common. Shallow pools are common after floods and after heavy rainfall. The areas range from about 3 to 30 acres in size. They are normally long and narrow, crescent or oblong. The slope range is 0 to 3 percent. Some areas that have been significantly altered by construction of the Lehigh Canal were included in mapping.

Although the deposits are too recent for soil horizons to have developed, plant cover is established in most areas.

Figure 16.—Abandoned house foundation on poorly drained Andover gravelly loam, 0 to 3 percent slopes.

The vegetation consists mainly of grasses, annual weeds, hawthorn, maple leaf viburnum, oak, and red maple.

This land is poorly suited to farming because of the flood hazard and the changeable, uneven surface. It is suited to tree plantings and to wildlife habitat. Capability unit IVw-1

Andover Series

The Andover series consists of deep, poorly drained, nearly level to gently sloping soils. These soils are in depressions, in drainageways, and along the base of mountains. Water from springs and seeps keeps them wet most of the year. These soils formed in colluvial or glacially influenced material weathered from sandstone, conglomerate, quartzite, and shale.

In a representative profile the surface layer is thin, very dark grayish-brown gravelly loam about 4 inches thick over a grayish-brown, gravelly silt loam subsurface layer that is about 5 inches thick. The upper part of the subsoil, between depths of 9 and 24 inches, is firm, gray, gravelly silt loam that has strong-brown mottles. The lower part of the subsoil is a gravelly loam, firm and brittle fragipan that has yellowish-brown and grayish-brown mottles. The fragipan is about 20 inches thick. The underlying material, at a depth of 44 inches, is dark yellowish-brown very gravelly loam.

Andover soils are slowly permeable. Even a small amount of rainfall makes them too wet to cultivate. During wet seasons, the water table is at or near the surface. Available moisture capacity is moderate.

Most of the acreage of these soils is wooded, but some areas are cleared and used for hay and pasture. The high water table and slow permeability (fig. 16) are limitations to most uses.

Representative profile of Andover gravelly loam within an area of Andover extremely stony loam, 0 to 8 percent slopes, in woodland, approximately 1 1/2 miles northwest of Clearfield:

O1—2 inches to 0, black (10YR 2/1) partly decayed organic matter.

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) gravelly loam; weak, fine, granular structure; friable when moist, slightly sticky when wet; 20 percent coarse fragments; strongly acid; abrupt, wavy boundary.

A2—4 to 9 inches, grayish-brown (10YR 5/2) gravelly silt loam; common, medium, prominent, strong-brown (7.5YR 5/6) mottles; weak, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; 20 percent coarse fragments; strongly acid; clear, wavy boundary.

B2t—9 to 24 inches, gray (10YR 5/1) gravelly silt loam; common, fine, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm when moist, slightly sticky when wet; patchy clay films on ped faces; 20 percent coarse fragments; strongly acid; clear, wavy boundary.

Bx—24 to 44 inches, gravelly loam; yellowish-brown gravelly loam; common, distinct, grayish-brown (10YR 5/2) mottles; gray (10YR 5/1) prism and ped faces; moderate, coarse, prismatic structure that parts to moderate, thick, platy; very firm when moist, and brittle when dry; thick, patchy clay films on ped faces; 35 percent coarse fragments; strongly acid; diffuse, wavy boundary.

C—44 to 60 inches, dary yellowish-brown (10YR 4/4) very gravelly loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, thick, platy structure; firm; 50 percent coarse fragments; strongly acid.

The solum ranges from 40 to 54 inches in thickness. Depth to hard bedrock is more than 6 feet. Depth to the fragipan is 16 to 28 inches.

The A1 horizon ranges from black to very dark grayish brown. The Ap horizon, where present, is very dark grayish brown to olive brown. The B2t horizon ranges from gray to light brownish gray. This horizon commonly is gleyed and it contains reddish-yellow, strong-brown, and yellowish-brown mottles. Texture is silt loam or sandy clay loam, or gravelly analogues. The Bx horizon ranges from gray to yellowish brown; mottles in this horizon are gray, grayish brown, and yellowish red. Texture of the Bx horizon ranges from gravelly loam to gravelly sandy clay loam, or cobbly analogues.

The C horizon ranges from yellowish brown to gray. Texture ranges from very gravelly loam to gravelly sandy loam and gravelly sandy clay loam, or cobbly analogues.

Andover soils in Northampton County have slightly more than 45 percent silt in the Bt horizon, in contrast to 25 to 45 percent as defined for the series, but this difference does not alter their use, management needs, or behavior.

Andover soils developed in the same kind of material as the well-drained Laidig soils and the moderately well drained and somewhat poorly drained Buchanan soils. They are similar in drainage to Baile, neutral variant, Red Hook, Chippewa, and Brinkerton soils. Unlike Andover soils, the Baile, neutral variant, and Red Hook soils lack a fragipan; Chippewa soils lack a Bt horizon; and Brinkerton soils have a finer textured solum that contains coarse fragments of shale and slate.

Andover gravelly loam, 0 to 3 percent slopes (AnA).—Areas of this soil are long and narrow or irregular in shape and range from 2 to 15 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer generally is 7 to 10 inches thick.

Included with this soil in mapping were small areas where the thickness of the surface layer has been increased by deposition of sediment. Also included were areas of Buchanan soils and areas of cobbly, flaggy, or stony soils.

Most of this Andover soil is cultivated or is in pasture. The high water table and slow permeability make this soil poorly suited to crops. The high water table and slow permeability are also limitations to most nonfarm uses. Capability unit IVw-2.

Andover gravelly loam, 3 to 8 percent slopes (AnB).—Areas of this soil are generally long and narrow or irregular in shape and range from 2 to 20 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is generally 7 to 10 inches thick. Drainage channels or gullies are common where slopes are more than 5 percent.

Included with this soil in mapping were small areas of soils that have slopes of more than 8 percent and areas of soils that have a cobbly, flaggy, or stony surface layer.

Most of this Andover soil is in crops or low-quality pasture. This soil is poorly suited to crops, but is suited to hay or pasture grasses adapted to wet soils. This soil has a high water table and slow permeability. The wetness and slow permeability are limitations to most nonfarm uses. Capability unit IVw-2.

Andover extremely stony loam, 0 to 8 percent slopes (AoB).—Areas of this soil are long and narrow or irregular in shape and range from 5 to 25 acres in size. This soil has the profile described as representative for the series. From 5 to 25 percent of the surface is covered by stones that are up to 6 to 10 feet in diameter.

Included with this soil in mapping were small areas of Stony land, Rubble land, and Andover soils that have a 25 to 50 percent stone cover.

Nearly all this Andover soil is wooded. This soil is too stony and too wet for cultivation. The stones, high water table, and slow permeability are limitations to most nonfarm uses. Capability unit VIIs-1.

Baile Series, Neutral Variant

The Baile series, neutral variant, consists of deep, poorly drained, nearly level to gently sloping soils. These soils are in depressions on uplands, in drainageways, and along the base of ridges. They formed in material weathered from quartzite, granite, gneiss, and schist. Seepage from springs keeps them wet most of the year.

In a representative profile the surface layer is dark grayish-brown silt loam about 6 inches thick. The upper part of the subsoil, between a depth of 6 to 18 inches, is light brownish-gray silt loam and gray silty clay loam that has yellowish-brown, yellowish-red and light-gray mottles. It is firm when moist and is slightly sticky and plastic in the lower part when wet. The lower part of the subsoil, between a depth of 18 to 52 inches, is firm cobbly silt loam and gravelly loam that has yellowish-red, light-gray, and reddish-gray mottles. The substratum is yellowish-red, loose, gravelly coarse sandy loam that has light-gray mottles.

Permeability is slow in the subsoil. Available moisture capacity is high, and tilth is generally poor.

The slow permeability and a high water table are limitations to most uses.

Representative profile of Baile silt loam, neutral variant, 2 to 8 percent slopes, in a pasture at the intersection of Ballick Road and County Line Road in Williams Township:

Ap—0 to 6 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, very fine, subangular blocky structure; friable, nonsticky, nonplastic; 5 percent coarse fragments; common, fine, iron concretions in lower 4 inches; neutral; abrupt, smooth boundary.

B1—6 to 10 inches, light brownish-gray (2.5Y 6/2) silt loam; many, fine, distinct, yellowish-brown (10YR 5/8) mottles; strong, very thin, platy structure; firm, nonsticky, nonplastic; 8 percent coarse fragments; slightly acid; abrupt, smooth boundary.

B2tg—10 to 18 inches, gray (10YR 6/1) silty clay loam; many, coarse, prominent, yellowish-red (5YR 4/8) and light-gray (10YR 7/2) mottles; moderate, coarse, subangular blocky structure; firm, slightly sticky, plastic; common, thick clay films on peds and in pores; 2 percent coarse fragments; neutral; clear, smooth boundary.

B31tg—18 to 30 inches, gray (10YR 6/1) cobbly silt loam; many, coarse, prominent, yellowish-red (5YR 4/8) and light-gray (10YR 7/1) mottles; weak, fine, subangular blocky structure; firm, slightly sticky, slightly plastic; few, fine, discontinuous clay films on ped faces; 35 percent coarse fragments; neutral; clear, smooth boundary.

B32tg—30 to 52 inches, pinkish-gray (5YR 7/2) gravelly loam; many, medium, faint, yellowish-red (5YR 4/8) and reddish-gray (5YR 5/2) mottles; weak, fine, subangular blocky structure; firm, nonsticky, nonplastic; few, thin, discontinuous clay films on ped faces and some thick clay and silt flows in pores; 30

TABLE 9.—*Approximate acreage and proprotionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Alluvial land, coal overwash	605	0.3	Comly silt loam, 3 to 8 percent slopes	8,850	3.7
Andover gravelly loam, 0 to 3 percent slopes	505	.2	Comly extremely stony silt loam, 0 to 8 percent slopes	1,005	.4
Andover gravelly loam, 3 to 8 percent slopes	1,085	.4	Conestoga silt loam, 2 to 8 percent slopes	2,915	1.2
Andover extremely stony loam, 0 to 8 percent slopes	790	.3	Conestoga silt loam, 8 to 15 percent slopes	2,660	1.1
Baile silt loam, neutral variant, 2 to 8 percent slopes	790	.3	Conestoga silt loam, 15 to 25 percent slopes	725	.3
Baile extremely stony silt loam, neutral variant, 0 to 8 percent slopes	845	.4	Conestoga and Hollinger extremely stony silt loams, 0 to 8 percent slopes	675	.3
Barbour soils	520	.2	Conestoga and Hollinger extremely stony silt loams, 8 to 25 percent slopes	4,730	2.0
Barbour and Middlebury soils, high bottom	765	.3	Conestoga and Hollinger extremely stony silt loams, 25 to 65 percent slopes	2,925	1.2
Bedington silt loam, 0 to 3 percent slopes	2,630	1.1	Conotton gravelly silt loam, 0 to 3 percent slopes	1,310	.5
Bedington shaly silt loam, 3 to 8 percent slopes	10,035	4.2	Conotton gravelly silt loam, 3 to 8 percent slopes	2,885	1.2
Bedington shaly silt loam, 8 to 15 percent slopes	800	.3	Conotton gravelly silt loam, 8 to 15 percent slopes	1,215	.5
Bedington extremely stony silt loam, 0 to 8 percent slopes	865	.4	Conotton gravelly silt loam, 15 to 25 percent slopes	790	.3
Berks shaly silt loam, 0 to 3 percent slopes	2,580	1.1	Conotton gravelly silt loam, 25 to 65 percent slopes	385	.2
Berks shaly silt loam, 3 to 8 percent slopes	21,175	8.9	Duffield silt loam, 0 to 3 percent slopes	665	.3
Berks shaly silt loam, 8 to 15 percent slopes	14,165	5.9	Duffield silt loam, 3 to 8 percent slopes	2,350	1.0
Berks shaly silt loam, 15 to 25 percent slopes	7,035	2.9	Halsey silt loam	715	.3
Berks and Weikert soils, 25 to 65 percent slopes	6,205	2.6	Hollinger gravelly silt loam, 3 to 8 percent slopes	1,005	.4
Brinkerton silt loam, 0 to 3 percent slopes	1,455	.6	Hollinger gravelly silt loam, 8 to 15 percent slopes	2,775	1.2
Brinkerton silt loam, 3 to 10 percent slopes	2,210	.9	Hollinger gravelly silt loam, 15 to 25 percent slopes	1,595	.7
Buchanan gravelly loam, 3 to 8 percent slopes	1,615	.7	Holly silt loam	3,070	1.3
Buchanan extremely stony loam, 0 to 8 percent slopes	1,700	.7	Laidig extremely stony silt loam, 0 to 8 percent slopes	2,275	.9
Chippewa silt loam, 0 to 2 percent slopes	365	.2	Laidig extremely stony silt loam, 8 to 25 percent slopes	2,505	1.0
Chippewa silt loam, 2 to 8 percent slopes	840	.4	Laidig extremely stony silt loam, 25 to 65 percent slopes	870	.4
Chippewa extremely stony silt loam, 0 to 8 percent slopes	2,260	.9	Middlebury soils	655	.3
Clarksburg silt loam, 0 to 3 percent slopes	2,990	1.3	Muck	160	.1
Clarksburg silt loam, 3 to 8 percent slopes	3,050	1.3	Phelps gravelly silt loam, thick solum variant, 2 to 8 percent slopes	905	.4
Comly silt loam, 0 to 3 percent slopes	2,350	1.0	Red Hook gravelly silt loam	1,370	.6

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TABLE 9.—*Approximate acreage and proportionate extent of the soils—Continued*

Soil	Acres	Percent	Soil	Acres	Percent
Rubble land	1,545	.7	Washington silt loam, 0 to 3 percent slopes	13,895	5.8
Ryder silt loam, 2 to 8 percent slopes	860	.4	Washington silt loam, 3 to 8 percent slopes	19,830	8.3
Ryder silt loam, 8 to 15 percent slopes	1,235	.5	Washington silt loam, 8 to 15 percent slopes	3,530	1.5
Stony land	4,470	1.9	Washington silt loam, 8 to 15 percent slopes, eroded	515	.2
Swartswood gravelly loam, 2 to 8 percent slopes	3,510	1.5	Washington silt loam, 15 to 25 percent slopes	1,260	.5
Swartswood gravelly loam, 8 to 15 percent slopes	1,490	.6	Washington very rocky silt loam, 25 to 75 percent slopes	970	.4
Swartswood gravelly loam, 15 to 25 percent slopes	390	.2	Weikert channery silt loam, 3 to 8 percent slopes	1,910	.8
Swartswood and Wurtsboro extremely stony soils, 0 to 8 percent slopes	2,945	1.2	Weikert channery silt loam, 8 to 15 percent slopes	2,810	1.2
Swartswood and Wurtsboro extremely stony soils, 8 to 25 percent slopes	1,515	.6	Weikert channery silt loam, 15 to 25 percent slopes	2,630	1.1
Urban land, nearly level	14,010	5.8	Wurtsboro gravelly silt loam, 2 to 8 percent slopes	3,010	1.2
Urban land, sloping	2,920	1.2	Wurtsboro gravelly silt loam, 8 to 15 percent slopes	860	.3
Urban land, occasionally flooded	1,870	.8	Miscellaneous areas (quarries, water)	5,575	2.3
Urbana silt loam, 2 to 10 percent slopes	1,290	.5			
Volusia gravelly silt loam, 2 to 8 percent slopes	795	.3			
Volusia extremely stony silt loam, 0 to 8 percent slopes	1,505	.6	Total	239,360	100.0

percent coarse fragments and a few cobblestones; neutral; abrupt, smooth boundary.

C—52 to 60 inches, yellowish-red (5YR 4/6) gravelly, coarse sandy loam; few, fine, prominent, light-gray (10YR 7/1) mottles; single grain; loose; 25 percent coarse fragments; neutral.

The solum ranges from 45 to 60 inches in thickness. Depth to hard bedrock is more than 5 feet.

The Ap horizon ranges from grayish brown to very dark gray. The A1 horizon, where present, ranges from very dark gray to black. The A2 horizon, where present, ranges from light brownish gray to dark grayish brown. The B2tg horizon ranges from silt loam to silty clay loam. The B31tg and B32tg horizons are cobbly silt loam, gravelly loam, or gravelly sandy clay loam.

The Baile soils, neutral variant, and the well-drained Conestoga and Hollinger soils, and the moderately well drained Urbana soils formed in similar material. Baile soils, neutral variant, are similar to Red Hook, Andover, Chippewa, and Brinkerton soils in drainage. Unlike Red Hook soils, Baile soils, neutral variant, have a Bt horizon, and they lack the fragipan characteristic of the Andover, Chippewa, and Brinkerton soils.

Baile silt loam, neutral variant, 2 to 8 percent slopes (BaB).—This soil is in narrow bands that range from 2 to 20 acres in size. This soil has the profile described as representative for the series. The areas along drainageways are subject to flooding and many areas in depressions pond during wet periods.

Included with this soil in mapping were areas of soils that are nearly level and areas of soils that have a more friable subsoil than this soil. Also included were areas of eroded soils and small areas of Urbana soils.

Most of this soil is cultivated, but some areas are in pasture or are wooded. Slow permeability and a high water table are limitations to most uses. Capability unit VIw-1.

Baile extremely stony silt loam, neutral variant, 0 to 8 percent slopes (BeB).—Areas of this soil are long and narrow or irregular in shape and range from 5 to 25 acres in size. From 10 to 20 percent of the surface is covered by stones. Flooding is a hazard, and many areas in depressions pond during wet periods.

Included with this soil in mapping were small areas of moderately well drained extremely stony soils. Also included were areas of soils that have short slopes as steep as 12 percent.

Most of this soil is in native pasture or has a cover of trees and brush. Stones on the surface make this soil unsuitable for crops. Wetness and stoniness make pasture maintenance difficult. Stoniness, slow permeability, and a high water table are limitations to nonfarm uses. Capability unit VIIs-1.

Barbour Series

The Barbour series consists of deep, well-drained, nearly level soils on flood plains and terraces along all the perennial streams in the county. These soils formed in mixed alluvial material deposited by streams.

In a representative profile the surface layer is dark reddish-brown fine sandy loam about 10 inches thick. The subsoil is very friable reddish-brown fine sandy loam about 18 inches thick. The underlying material is brown to reddish-brown fine sand and sand.

Barbour soils have moderately rapid permeability and moderate available moisture capacity. Although some areas are subject to flooding, most are above yearly overflow levels. Flooding is somewhat more frequent along smaller streams than along the Delaware River. They generally are not scoured, but do have an uneven surface in many areas.

Most of the acreage of these soils is farmed; some areas are urbanized; the rest is idle or wooded. Flooding is a limitation to most uses.

Representative profile of Barbour fine sandy loam, in an area of Barbour soils in a nearly level idle field adjacent to Thomas Island in Upper Mount Bethel Township:

Ap—0 to 10 inches, dark reddish-brown (5YR 3/3) fine sandy loam; weak, fine, granular structure; friable, nonsticky, nonplastic; medium acid; clear, smooth boundary.

B2—10 to 28 inches, reddish-brown (5YR 4/3) fine sandy loam; weak, fine, subangular blocky structure that parts to weak, medium, granular; very friable, nonsticky, nonplastic; slightly acid; clear, smooth boundary.

IIC1—28 to 46 inches, brown (7.5YR 4/4) fine sand; single grain; very friable, nonsticky, nonplastic; slightly acid; abrupt, smooth boundary.

IIIC2—46 to 64 inches, reddish-brown (5YR 4/4) sand; single grain; friable, nonsticky, nonplastic; slightly acid.

The solum ranges from brown to dark reddish brown. Depth to bedrock is more than 6 feet.

The Ap horizon ranges from silt loam to sandy loam. The B2 horizon ranges from fine sandy loam to loam. The IIIC2 horizon ranges from loamy sand to fine sand and has varying amounts of shale chips, gravel and cobblestones.

Barbour soils in Northampton County have a slightly higher pH than is defined for the series, but this difference does not alter their use, management needs, or behavior.

Barbour soils, the deep, moderately well drained to somewhat poorly drained Middlebury soils, and the poorly drained and very poorly drained Holly soils formed in similar material. Barbour soils lack the Bt horizon of the Conotton soils on nearby stream terraces.

Barbour soils (0 to 3 percent slopes) (Bg).—These nearly level soils are on flood plains. The areas are long and narrow and range from 2 to 20 acres in size. This soil has the profile described as representative for the series, but its surface layer ranges from silt loam to sandy loam.

Included with this soil in mapping were areas of soils that have a silt loam subsoil, and that are less red than this soil. These areas are mainly along streams that drain limestone and shale uplands. Gravel and cobblestones are common along small streams flowing from the base of Blue Mountain.

Barbour soils are suited to all crops commonly grown in the county. The frequency and regularity of flooding varies from one area to another and onsite investigation is needed to determine the severity of the flooding hazard. Capability unit IIw-1.

Barbour and Middlebury soils, high bottom (0 to 5 percent slopes) (Bm).—These soils are on smooth and high bottoms, benches, and stream terraces throughout the county. The areas are long and narrow and range from 2 to 20 acres in size. Mapped areas consist of Barbour soil, Middlebury soil, or both. About 70 percent of this unit generally is Barbour soils, and 30 percent is Middlebury soils. The profile of each soil is similar to the one described as representative for its series.

Included with these soils in mapping were areas of soils where the subsoil is lighter in color, and stronger in structure than that of these soils, and it has more clay.

These soils are suited to all crops commonly grown in the county. The frequency and regularity of flooding varies from one area to another, and onsite investigation is needed to determine the severity of the flooding hazard. Capability unit IIw-1.

Bedington Series

The Bedington series consists of deep, well-drained soils that formed in material weathered from till or frost-churned, acid, gray shale (fig. 17). These nearly level to sloping and undulating to rolling soils are on ridges and in valleys in the northern part of the county.

In a representative profile the surface layer is dark-brown shaly silt loam about 9 inches thick. The upper part of the subsoil, at a depth between 9 and 23 inches, is yellowish-brown shaly silt loam. The lower part of the subsoil, at a depth between 23 and 48 inches is strong-brown shaly silt

Figure17.—Typical underlying material of Bedington soils. The uppermost 2 to 3 feet of material has been removed for use as topsoil.

loam. The substratum, to a depth of 60 inches, is brown very shaly loam. At a depth of about 60 inches is olive-gray fractured shale.

Bedington soils have moderate to high available moisture capacity and moderate permeability.

Most of the acreage of these soils is farmed. Some areas are used as homesites, and the rest is wooded or idle. The hazard of erosion is the main limitation to most uses.

Representative profile of Bedington shaly silt loam, 3 to 8 percent slopes, in a field, 1 1/4 miles west of Moorestown along State Route 946:

Ap—0 to 9 inches, dark-brown (10YR 3/3) shaly silt loam; weak, fine, granular structure; friable, nonsticky, nonplastic; 15 percent shale fragments; neutral; abrupt, smooth boundary.

B1—9 to 15 inches, yellowish-brown (10YR 5/4) shaly silt loam; weak, fine, subangular blocky structure; friable, slightly sticky, nonplastic; very, thin patchy clay film on peds; 20 percent shale fragments; slightly acid; abrupt, wavy boundary.

B21t—15 to 23 inches, yellowish-brown (10YR 5/4) shaly silt loam; moderate, medium, subangular blocky structure; friable, slightly sticky, slightly plastic; thin clay film patches on peds; 20 percent shale fragments; medium acid; abrupt, wavy boundary.

B22t—23 to 48 inches, strong-brown (7.5YR 5/6) shaly silt loam; weak, medium, subangular blocky structure; friable, sticky, plastic; few thin clay films on fragments; 30 percent shale; medium acid; clear, wavy boundary.

C—48 to 60 inches, brown (7.5YR 5/4) very shaly loam; massive; friable; 70 percent shale; medium acid.

R—60 inches, olive-gray fractured shale.

The solum ranges from 42 to 72 inches in thickness. Depth to hard bedrock is more than 4 feet.

The Ap horizon ranges from dark brown to dark yellowish brown. The B1 horizon ranges from silt loam to shaly silt loam. The B21t and B22t horizons range from silt loam to shaly sandy clay loam. The C horizon ranges from very shaly loam to very shaly sandy clay loam.

Bedington soils in Northampton County have a slightly higher pH than is defined for the series, but this difference does not alter their use, management, or behavior.

Bedington soils, the well-drained and moderately deep Berks soils, the moderately well drained to somewhat poorly drained Comly soils, and the poorly drained Brinkerton soils formed in similar material. Bedington soils have characteristics similar to Laidig, Swartswood, Connestoga, Duffield, and Washington soils. They lack the fragipan of the Laidig and Swartswood soils. They have a shaly component within the solum, which is absent in the Conestoga, Duffield, and Washington soils.

Bedington silt loam, 0 to 3 percent slopes (BnA).—This soi has uniform slopes and is on moderately broad ridgetops, till plains, and benches along the larger drainageways of the county. Most areas range from 4 to more than 15 acres in size. The profile of this soil is similar to the one described as representative for the series, except that the surface layer has fewer coarse fragments.

Included with this soil in mapping were areas of soils in small depressions that are mottled at a depth of about 36 inches.

This Bedington soil is well suited to all crops commonly grown in the county. Capability unit I-1.

Bedington shaly silt loam, 3 to 8 percent slopes (BoB).—This undulating soil is in areas that range from 6 to more than 30 acres in size. It has the profile described as representative for the series.

Included with this soil in mapping were areas of Laidig soils at the base of Blue Mountain.

This Bedington soil is suited to all crops commonly grown in the county. Most of this soil is used for cultivated crops, but some gently sloping areas that are accessible are used as residential building sites. Capability unit IIe-2.

Bedington shaly silt loam, 8 to 15 percent slopes (BoC).—This rolling soil is in areas that range from about 4 to 15 acres in size. The profile of this soil is similar to the profile described as representative for the series, except the surface layer and subsoil combined are thinner, and it contains more shale fragments. Evidence of sheet erosion and rilling is common. In some areas, significant amounts of material in the subsoil have been mixed with that in the plow layer.

Included with this soil in mapping were small areas of soils at the base of slopes that are mottled at a depth of about 36 inches. Also included were a few acres of Laidig soils on the foot slopes of Blue Mountain.

A high erosion hazard and a high content of shale are the major limitations to most uses. Capability unit IIIe-1.

Bedington extremely stony silt loam, 0 to 8 percent slopes (BpB).—Areas of this soil are long and narrow and range from 5 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but stones cover 10 to 25 percent of the surface.

Included with this soil in mapping were some areas that are not stony and areas where stones cover up to 50 percent of the surface. Also included were small areas of extremely stony Comly and Brinkerton soils.

Most of this soil is wooded. The extremely stony surface is a limitation to most uses. Capability unit VIIs-3.

Berks Series

The Berks series consists of moderately deep, well-drained soils on uplands. These nearly level to very steep soils are on the ridges and in valleys in the northern part of the county. They formed in material weathered from till or frost-churned, acid, gray shale.

In a representative profile the surface layer is very dark grayish-brown shaly silt loam about 9 inches thick. The subsoil, to a depth of 28 inches, is yellowish-brown, friable shaly silt loam. The underlying material is yellowish-brown very shaly silt loam. Fractured shale bedrock is at a depth of 38 inches.

Berks soils have moderately rapid permeability and moderate to low available moisture capacity. Shallowness to bedrock and the high content of coarse fragments are limitations to most uses.

Representative profile of Berks shaly silt loam, 3 to 8 percent slopes, in a cultivated field, 1 mile south of Moorestown:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) shaly silt loam; weak, fine, granular structure; very friable, nonsticky, nonplastic; 30 percent shale fragments; neutral; abrupt, smooth boundary.

B2—9 to 28 inches, yellowish-brown (10YR 5/4) shaly silt loam; moderate, fine, subangular blocky structure; friable, slightly sticky, nonplastic; thin clay films in pores; 35 percent shale fragments; medium acid; clear, wavy boundary.

C—28 to 38 inches, yellowish-brown (10YR 5/4) very shaly silt loam; massive; very friable, slightly sticky, nonplastic; few, thin, clay film patches on coarse fragments; 75 percent shale fragments; medium acid.

R—38 inches, fractured shale.

The solum ranges from 20 to 36 inches in thickness. Depth to fractured bedrock ranges from 20 to 40 inches.

The B2 horizon is commonly yellowish brown, but it ranges from strong brown in the upper part to yellowish red in the lower part. The B2 horizon ranges from shaly silt loam to very shaly loam. The content of coarse fragments in the C horizon increases with depth, and in places it is as much as 90 percent of the mass. Coarse fragments are mostly shale, but rounded gravel is common.

Berks soils, the shallow, well-drained Weikert soils, the deep, well-drained Bedington soils, the deep, moderately well drained to somewhat poorly drained Comly soils, and the deep, poorly drained Brinkerton soils formed in similar material. Berks soils are similar to Ryder and Hollinger soils, but they have a thicker solum than these soils. They have a higher content of coarse fragments throughout the solum than Ryder soils, and they lack the Bt horizon of Hollinger soils.

Berks shaly silt loam, 0 to 3 percent slopes (BrA).—This soil is on uniform, slightly convex hillsides and ridgetops. The areas range from 2 to 15 acres in size. The profile of this soil is similar to the one described as representative for the series, but fewer coarse fragments are throughout, and the subsoil is somewhat more reddish and more distinct.

This Berks soil is suited to all crops commonly grown in the county. Droughtiness and susceptibility to erosion are the main limitations to farm uses. Shallowness to bedrock and a high content of coarse fragments are the major limitations to most nonfarm uses. Capability unit IIe-3.

Berks shaly silt loam, 3 to 8 percent slopes (BrB).—This soil is on convex hillsides and ridgetops. The areas range from 5 to more than 50 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of gravelly soils that have moderate permeability, small areas of soils that have a sandy substratum, and a few areas of soils that have a fragipan in the subsoil.

This Berks soil is suited to all crops commonly grown in the county. Accessibility and nearness to urban centers have encouraged extensive use of this soil as homesites. The erosion hazard and droughtiness are the major limitations to farming. Shallowness to bedrock and a high content of shale are major limitations to most nonfarm uses. Capability unit IIe-3.

Berks shaly silt loam, 8 to 15 percent slopes (BrC)—This soil is on convex hillsides and ridges. The areas range from 2 to more than 30 acres in size. The profile of this soil is similar to the one described as representative for the series, but it is thinner and the surface layer commonly is 30 percent coarse fragments as much as 1 inch in diameter. Cleared areas are moderately to severely eroded.

Included with this soil in mapping were small areas of gravelly soils that have moderate permeability, small areas of soils that have a sandy substratum, and small areas of soils that have a fragipan in the subsoil.

Although this soil has a high erosion hazard and is somewhat droughty, it is suited to all crops in the county commonly grown (fig. 18). Shallowness to bedrock, steepness of slope, and high content of shale are major limitations to most nonfarm uses. Capability unit IIIe-3.

Berks shaly silt loam, 15 to 25 percent slopes (BrD).—This soil is on smooth or convex hillsides and ridges and along deeply cut drainageways. The areas generally occur as moderately wide bands that follow the general contour of the hill and range from 2 to more than 25 acres in size. The profile of this soil is similar to the one described as representative for the series, but it is thinner, and in many places the surface layer contains as much as 40 percent coarse fragments as large as 1 inch in diameter. Rills are common and permeability is moderately rapid.

Included with this soil in mapping were small areas of Ryder, Weikert, and Bedington soils that have similar slopes. Also included were areas of gravelly soils that have moderate permeability, areas of soils that have a sandy substratum, and small areas of soils that have a fragipan in the subsoil.

Steepness of slope, droughtiness, and the erosion hazard make this Berks soil poorly suited to cultivated crops. Steepness of slope is a severe limitation to most nonfarm uses, but wide areas are suited to such winter recreation as skiing and sledding. Capability unit IVe-2.

Figure 18.—Berks shaly silt loam, 8 to 15 percent slopes. Contour strip-cropping and a diversion terrace help to control erosion.

Berks and Weikert soils, 25 to 65 percent slopes (BsF).—These soils are on hillsides and ridges and along deeply cut drainageways. The areas are long and narrow and range from 5 to more than 50 acres in size. Mapped areas consist of Berks soil, Weikert soil, or both. Generally, 65 to 80 percent of this unit is Berks soil, and 35 to 20 percent is Weikert soil. The profile of each soil is similar to the one described as representative for its series, except that it is thinner. The surface layer ranges from shaly silt loam to channery or gravelly silt loam.

These soils are too steep for crops and for most nonfarm uses. Wide areas are suited to such winter recreation as skiing and sledding. Capability unit VIIe-1.

Brinkerton Series

The Brinkerton series consists of deep, poorly drained soils that formed in glacially influenced colluvial material weathered from frost-churned acid gray shale. These soils are nearly level to sloping and are mainly in and along drainageways.

In a representative profile the surface layer is dark grayish-brown silt loam about 9 inches thick. The upper part of the subsoil, to a depth of about 21 inches, is friable, light brownish-gray silty clay loam that has brownish-yellow and gray mottles. Between a depth of 21 to 45 inches is a fragipan layer of gray and light-gray silty clay loam that has gray, reddish-yellow, and brownish-yellow mottles. The amount of shale increases with the depth. The fragipan substratum extends to a depth of more than 60 inches. It is very firm, gray, very shaly loam fragipan that contains about 90 percent shale chips.

Permeability is slow. Available moisture capacity is low. A water table is at or near the surface during wet periods. Ponding occurs during periods of heavy rain and spring thaw.

Most areas of these soils are used for pasture, but some are idle, and the rest are wooded. A high water table and slow permeability are the major limitations to most nonfarm uses.

Representative profile of Brinkerton silt loam, 3 to 10 percent slopes, in a pasture, 1 1/2 miles west of Cherry Hill in Bushkill Township:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable, slightly sticky, slightly plastic; 5 percent gravel; neutral; abrupt, smooth boundary.

B2tg—9 to 21 inches, light brownish-gray (10YR 6/2) silty clay loam; many, medium, distinct, brownish-yellow (10YR 6/6) and gray (10YR 6/1) mottles; moderate, medium, subangular blocky structure; friable, sticky, plastic; common, clay film patches in pores and on peds; 12 percent gravel and shale chips; slightly acid; clear, wavy boundary.

Bx1g—21 to 36 inches, gray (10YR 6/1) silty clay loam; many, coarse, prominent, reddish-yellow (7.5YR 6/8) and gray (N 5/0) mottles; weak, coarse, prismatic structure that parts to moderate, medium and coarse, subangular blocky; firm, brittle, sticky, plastic; many clay films on prisms; 12 percent gravel and shale chips; medium acid; gradual, wavy boundary.

Bx2g—36 to 45 inches, light-gray (N 7/0) shaly silty clay loam; common, fine, prominent, reddish-yellow (7.5YR 7/6) and brownish-yellow (10YR 6/8) mottles; weak, coarse, prismatic structure that parts to moderate, coarse, blocky; firm, brittle, sticky, and plastic; common clay films on peds; 20 percent shale chips; medium acid; gradual, wavy boundary.

Cxg—45 to 60 inches, gray (N 6/0) very shaly loam; massive; very firm, brittle, nonsticky, nonplastic; 90 percent shale chips; slightly acid.

The solum ranges from 40 to 50 inches in thickness. Depth to hard bedrock is more than 5 feet. Depth to the fragipan is 18 to 24 inches.

The Ap horizon ranges from very dark grayish brown to grayish brown. The B2tg horizon ranges from gray to light brownish gray in color and from silty clay loam and clay loam to silt loam in texture. The Bx1g and Bx2g horizons range from light gray to grayish brown. The C horizon ranges from light gray to grayish brown and contains 65 to 90 percent shale chips.

Brinkerton soils in Northampton County have slightly more than 15 percent fine sand and are coarser in the B2tg horizon than is defined for the series, but these differences do not alter their use, management, or behavior.

Brinkerton soils, the well-drained Weikert, Berks, and Bedington soils, and the moderately well drained and somewhat poorly drained Comly soils formed in similar material. Brinkerton soils are similar to Baile soils, neutral variant, and the Red Hook, Chippewa, and Andover soils in drainage. They have a fragipan that the Baile, neutral variant, and Red Hook soils lack and a Bt horizon that the Chippewa soils lack. They are not so coarse textured as Andover soils.

Brinkerton silt loam, 0 to 3 percent slopes (BtA).—This soil is along upland stream heads, in drainageways, and at the foot of long toe slopes. The areas are generally oval or long and narrow and range from 2 to 15 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is thicker, and it is grayer near the surface.

Included with this soil in mapping were small areas of soils that are very poorly drained and small areas of soils that have a gravelly, cobbly, and flaggy surface layer.

This Brinkerton soil is poorly suited to cultivated crops. It is suited to hay and to summer and fall pasture. A high water table and slow permeability are major limitations to most nonfarm uses. Capability unit IVw-2.

Brinkerton silt loam, 3 to 10 percent slopes (BtB).—This soil is along stream heads, in drainageways, and at the foot of long toe slopes. The areas are generally long and narrow and range from 2 to more than 20 acres in size. This soil has the profile described as representative for the series. Drainage channels or small gullies are common where slopes are more than 5 percent.

Included with this soil in mapping were areas where slopes are less than 3 percent and areas of soils that have a cobbly, gravelly, flaggy, or stony surface layer.

Wetness makes this Brinkerton soil poorly suited to cultivated crops. It is suited to hay and to pasture grasses that can tolerate wetness. A high water table and slow permeability are the major limitations to most nonfarm uses. Capability unit IVw-2.

Buchanan Series

The Buchanan series consists of deep, moderately well drained and somewhat poorly drained, nearly level to gently sloping soils. These soils are on the smooth or slightly concave lower foot slopes of mountains. They formed in colluvial or glacially influenced material weathered from sandstone, conglomerate, quartzite, and shale.

In a representative profile the surface layer is dark-brown gravelly loam about 8 inches thick. The upper part of the subsoil consists of light yellowish-brown silt loam over strong-brown clay loam that has grayish-brown and yellowish-brown mottles. The lower part of the subsoil, between a depth of 24 to 43 inches, is firm, yellowish-brown clay loam and a gravelly loam fragipan that becomes coarser and firmer with increasing depth. It is brittle and has many, coarse, prominent, pale-brown, strong-brown, and yellowish-brown mottles. The substratum is firm, brittle, yellowish-brown, very shaly loam fragipan.

Permeability is slow in these soils, and available moisture capacity is moderate. The water table rises to within 1 to 3 feet of the surface during wet periods. Soils in depressions are frequently ponded. The slowly permeable subsoil and the high water table are limitations to most nonfarm uses.

Representative profile of Buchanan gravelly loam, 3 to 8 percent slopes, along a pipeline right-of-way, 1.2 miles southwest of Danielsville in Lehigh Township:

Ap—0 to 8 inches, dark-brown (10YR 4/3) gravelly loam; weak, fine, granular structure; friable, slightly sticky, slightly plastic; 18 percent gravel; medium acid; abrupt, wavy boundary.

B1—8 to 12 inches, light yellowish-brown (10YR 6/4) silt loam; weak, thick, platy structure parting to weak, very fine, subangular blocky; friable, sticky, plastic; few, thin clay films in pores; 10 percent gravel; medium acid; clear, wavy boundary.

B21t—12 to 16 inches, light yellowish-brown (10YR 6/4) heavy silt loam; many, medium, faint, yellowish-brown (10YR 5/6 and 5/8) mottles; weak, thick, platy structure that parts to weak, very fine, subangular blocky; friable, sticky, plastic; common, thick clay films in pores; 12 percent gravel; strongly acid; clear, wavy boundary.

B22t— 16 to 24 inches, strong-brown (7.5YR 5/6) clay loam; many, medium, distinct, grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable, sticky, plastic; common, thick clay films in pores; 14 percent gravel; strongly acid; abrupt, smooth boundary.

Bx1g—24 to 37 inches, yellowish-brown (10YR 5/6) clay loam; light-gray; many, coarse, prominent, strong-brown (7.5YR 5/6), pale-brown (10YR 6/3), and yellowish-brown (10YR 5/6) mottles; light-gray (N 7/0) prism faces; weak, coarse, prismatic structure that has weak, medium, platy interiors; firm, brittle, sticky, plastic; common, thick clay films in pores and on ped faces; 14 percent gravel; medium acid; clear, wavy boundary.

Bx2g—37 to 43 inches, yellowish-brown (10YR 5/6) gravelly loam; many, coarse, prominent, strong-brown (7.5YR 5/6), pale-brown (10YR 6/3), and yellowish-brown (10YR 5/6) mottles; light-gray (N 7/0) prism faces; weak, coarse, prismatic structure that has weak, medium and thin, platy interiors; very firm, brittle, slightly sticky, slightly plastic; common thin clay films in pores and on prism faces, 30 percent gravel; medium acid; abrupt, wavy boundary.

Cx—43 to 66 inches, yellowish-brown (10YR 5/6) very shaly loam; massive; firm, brittle, nonsticky, nonplastic; 60 percent gravel and shale chips; medium acid.

The solum ranges from 40 to 60 inches in thickness. Depth to hard bedrock ranges from more than 5 feet to more than 10 feet. Depth to the fragipan ranges from 20 to 30 inches. The content of coarse fragments ranges from 5 to 25 percent in the upper solum and from 10 to 60 percent in the fragipan.

The Ap horizon ranges from dark grayish brown to brown. Mottles in the B21t and B22t horizons range from dark grayish brown to reddish yellow. The B21t and B22t horizons range from silt loam to clay loam. The Bx1g and Bx2g horizons range from sandy loam to clay loam, or channery, gravelly, and shaly analogues. The Cx horizon ranges from gray to yellowish brown in color and ranges in texture from loam to sandy clay loam or shaly, gravelly and channery analogues in texture. The Cx horizon is massive or has weak, coarse, prismatic structure.

Buchanan soils in Northampton County have a slightly higher pH in the fragipan than is defined for the series, but this difference does not alter their use, management, or behavior.

Buchanan soils, the well-drained Laidig soils, and the poorly drained Andover soils formed in similar material. Buchanan soils are similar to Volusia, Wurtsboro, Phelps, Comly, Urbana, and Clarksburg soils in drainage. They have a Bt horizon that the Volusia and Wurtsboro soils lack and a fragipan that the Phelps soils lack. They have more gravel within the solum than the Comly, Urbana, and Clarksburg soils.

Buchanan gravelly loam, 3 to 8 percent slopes (BuB).—Areas of this soil are long and narrow or irregular in shape and range from 3 to more than 30 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were some areas where material from the subsoil has been plowed into the surface layer. Also included were areas of Andover soils in small depressions.

Most of this soil is used for crops. The high water table and slow permeability are limitations to most uses. Capability unit IIe-1.

Buchanan extremely stony loam, 0 to 8 percent slopes (BvB).—Areas of this soil are long and narrow or irregular in shape and range from 5 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but stones cover 10 to 25 percent of the surface.

Included with this soil in mapping were small areas of Stony land and some areas where less than 10 percent of the surface is covered with stones.

Most of this Buchanan soil is wooded. Stones on the surface make this soil unsuited to crops. The stony surface, high water table, and slow permeability are limitations to most uses. Capability unit VIIs-3.

Chippewa Series

The Chippewa series consists of deep, poorly drained, nearly level to gently sloping soils in swales, drainageways, and low-lying upland flats. These soils formed in compact glacial till composed of material weathered from gray shale, sandstone, siltstone, quartzite, and small amounts of limestone. This till is primarily deposited over shale and slate uplands.

In a representative profile the surface layer, about 9 inches thick, is very dark gray to very dark grayish-brown silt loam that has dark-brown mottles in the lower part. The upper part of the subsoil, between a depth of 9 to 17 inches, consists of a thin layer of grayish-brown silt loam over a layer of light-gray gravelly loam and has dark-brown and light yellowish-brown mottles. The subsoil, below a depth of 17 inches, is a light-gray, gravelly loam fragipan that has light yellowish-brown, yellowish-brown, and strong-brown mottles. It is firm and brittle and extends below a depth of 80 inches.

Permeability is slow, and available moisture capacity is moderate to low. The water table is at or near the surface during wet periods (fig. 19). There is frequent ponding in depressions during periods of heavy rain or spring thaw.

Slow permeability and a high water table are limitations to use of these soils.

Representative profile of Chippewa silt loam, in a wooded area of Chippwa extremely stony silt loam, 0 to 8 percent slopes three-fourths mile south of East Bangor in Washington Township. (This is the location of profile S67Pa-48-17 (1-9) for which physical and chemical data are given in tables 11 and 12.):

A11—0 to 5 inches, very dark gray (10YR 3/1) silt loam; moderate, fine and medium, granular structure; very friable, nonsticky, nonplastic; 5 percent gravel; medium acid; abrupt, smooth boundary.

A12—5 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; many, fine, distinct, dark-brown (7.5YR 4/4) mottles; moderate, medium, granular structure; friable, slightly sticky, slightly plastic; 5 percent gravel; medium acid; clear, wavy boundary.

B21g—9 to 11 inches, grayish-brown (10YR 5/2) silt loam; many, medium, distinct, dark-brown (7.5YR 4/4) and yellowish-brown (10YR 5/4) mottles; weak, thick, platy structure that parts to moderate, fine, subangular blocky; friable, slightly sticky, plastic; few thin clay films lining pores; 5 percent gravel; medium acid; clear, wavy boundary.

B22g—11 to 17 inches, light-gray (5Y 7/1) gravelly loam; many, medium, distinct, light yellowish-brown (10YR 6/4) mottles; moderate, medium, prismatic structure that parts to weak, medium, subangular blocky; firm, slightly sticky, plastic; few thin clay films line pores; 15 percent gravel and cobblestones; medium acid; clear, wavy boundary.

Bx1g—17 to 28 inches, light-gray (5Y 7/1) gravelly loam; many, medium, distinct, light yellowish-brown (2.5Y 6/4) and yellowish-brown (10YR 5/6) mottles; moderate, very coarse, prismatic structure that parts to weak, medium, subangular blocky and weak, thin, platy; firm, brittle, slightly sticky, plastic; common, medium, moderately thick clay film patches on peds and lining pores; 35 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx2g—28 to 41 inches, light-gray (5Y 7/1) gravelly loam; many, medium, distinct, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/4) mottles; moderate, very coarse, prismatic structure that parts to weak, medium, subangular blocky and weak, thin,

Figure 19.—High water table in Chippewa extremely stony silt loam after heavy summer rain.

platy; firm, brittle, nonsticky, slightly plastic; common, moderately thick clay films and patches on peds and pore linings 35 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx3g—41 to 54 inches, light-gray (5Y 7/1) gravelly loam; many, medium, distinct, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/4) mottles; moderate, very coarse, prismatic structure that parts to weak and moderate, medium, subangular blocky and weak, thin, platy; firm, brittle, nonsticky, plastic; many moderately thick clay films in pores; 30 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx4g—54 to 64 inches, light-gray (5Y 7/1) gravelly loam; many, medium, distinct, light yellowish-brown (10YR 6/4) and strong-brown (7.5YR 5/6) mottles; moderate, very coarse, prismatic structure that parts to weak and moderate, medium, subangular blocky and moderate, medium, platy; firm, brittle, slightly sticky, plastic; few, moderately thick clay films in pores; common, thin, black, iron and manganese coatings; 40 percent gravel and cobblestones; neutral; gradual, wavy boundary.

Bx5g—64 to 80 inches, light-gray (5Y 7/1) gravelly loam; many, medium, distinct, light yellowish-brown (10YR 6/4) and strong-brown (7.5YR 5/6) mottles; moderate, very coarse, prismatic structure that parts to weak, medium, subangular blocky and weak, thin, platy; firm, brittle, slightly sticky, plastic; few, moderately thick clay films in pores; many, thin, black, iron and manganese coatings; 50 percent gravel and cobblestones; neutral.

The solum ranges from 40 inches to more than 72 inches in thickness. Depth to fragipan is from 12 to 20 inches. Content of coarse fragments ranges from 5 to 35 percent above the Bx1g horizon and from 25 to 50 percent in the Bx horizon. The A11 and A12 horizons range from black to very dark grayish brown.

Chippewa soils in Northampton County have a slightly thicker solum and higher color values in the Bx horizon than is defined for the Chippewa series, but these differences do not alter their use, management, or behavior.

Chippewa soils, the well-drained Swartswood soils, the moderately well drained Wurtsboro soils, and the somewhat poorly drained Volusia soils formed in similar material. Chippewa soils are similar to the Baile, Red Hook, Andover, and Brinkerton soils in drainage. They have a fragipan that is absent in the Baile and Red Hook soils, and they lack the Bt horizon of the Andover and Brinkerton soils.

Chippewa silt loam, 0 to 2 percent slopes (ChA).—This soil is in drainageways, potholes, and closed depressions. The areas generally are round or oval and range from 2 to 30 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is black and about 9 inches thick, and the upper part of the subsoil is grayer.

Included with this soil in mapping were small areas that are gravelly, cobbly, or stony.

The high water table, slow permeability, and surface ponding for extended periods are limitations to most uses. The low lying position of this soil makes it difficult to establish drainage outlets. Capability unit IVw-2.

Chippewa silt loam, 2 to 8 percent slopes (ChB).—This soil is on broad upland toe slopes and in drainageways. The areas are generally oval or long and narrow and range from 2 to 20 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is 6 to 9 inches thick. Drainage channels or gullies are common where slopes are more than 5 percent.

Included with this soil in mapping were small areas where the surface layer is gravelly, cobbly, or flaggy.

The high water table and slow permeability are limitations to most uses. Capability unit IVw-2.

Chippewa extremely stony silt loam, 0 to 8 percent slopes (CkB).—This soil is on broad upland flats, on toe slopes, and in drainageways. The areas are irregular in shape and range from 5 to more than 50 acres in size. This soil has the profile described as representative for the series. Stones cover 5 to 20 percent of the surface.

Included with this soil in mapping were small areas of Chippewa silt loam, 0 to 2 percent slopes.

Nearly all of this soil is wooded, idle, or in pasture. This soil is too stony and too wet to be cultivated or properly managed for pasture. Stoniness and a high water table are limitations to most uses. Capability unit VIIs-1.

Clarksburg Series

The Clarksburg series consists of deep, moderately well drained, nearly level to gently sloping soils that formed in material weathered from limestone, "cement rock," and small amounts of shale. These soils are in drainageways and on lower toe slopes and have a predominantly southern exposure.

In a representative profile the surface layer is dark-brown silt loam about 9 inches thick. The upper part of the subsoil, between a depth of 9 to 29 inches, is brown and yellowish-brown silt loam that contains 5 percent gravel, mostly chert and shale. The lower part of the subsoil, below a depth of 29 inches, is very firm fragipan. The fragipan is yellowish-brown silt loam that has prominent, light-gray and strong-brown mottles. It overlies a gravelly sandy loam substratum at a depth of about 42 inches.

Clarksburg soils have slow permeability and high available moisture capacity. The water table is within a depth of 1 1/2 to 3 feet during wet periods. Most areas of these soils are cultivated. These soils are suited to all crops commonly grown in the county; however, alfalfa and winter grains are damaged by frost heaving. Slow permeability and a seasonal high water table are the major limitations to most uses.

Representative profile of Clarksburg silt loam, 0 to 3 percent slopes, in a cultivated field, at Newburg in Lower Nazareth Township:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; weak, very fine, granular structure; very friable, nonsticky, nonplastic; 5 percent coarse fragments; moderately alkaline; clear, smooth boundary.

B1—9 to 18 inches, brown (10YR 5/3) silt loam; moderate, fine and medium, subangular blocky structure; friable, nonsticky, nonplastic; 5 percent coarse fragments; mildly alkaline; clear, smooth boundary.

B21t—18 to 24 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; friable, slightly sticky, slightly plastic; few thin clay films in root channels; 5 percent coarse fragments; mildly alkaline; abrupt, wavy boundary.

B22t—24 to 29 inches, yellowish-brown (10YR 5/8) heavy silt loam; moderate, medium, prismatic structure parting to moderate, fine and medium, blocky; firm, slightly sticky, slightly plastic; common, thin clay films on peds and in root channels; 5 percent coarse fragments; mildly alkaline; abrupt, smooth boundary.

Bx—29 to 42 inches, yellowish-brown (10YR 5/4) silt loam; many, coarse, prominent, strong-brown (7.5YR 5/6) and light-gray (N 7/0) mottles; moderate, very coarse, prismatic structure that parts to weak, coarse, blocky; very firm, brittle, sticky; slightly plastic; few thin clay films in pores; 12 percent coarse fragments; neutral; abrupt, wavy boundary.

C—42 to 60 inches, dark yellowish-brown (10YR 3/4) gravelly sandy loam; massive; firm, nonsticky, nonplastic; 30 percent coarse fragments; mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. Depth to hard bedrock is more than 6 feet. Depth to fragipan is from 24 to 36 inches.

The Ap horizon ranges from very dark grayish brown to dark yellowish brown. The B21t and B22t horizons range from light yellowish brown to strong brown. The content of silt ranges from 30 to 50 percent where this soil is associated with Washington soils and from 45 to 65 percent where it is associated with Duffield soils. The Bx horizon is dark yellowish-brown to dark grayish-brown silt loam or loam. The C horizon is brown, dark grayish brown, or dark yellowish brown and is from 15 to 50 percent gravel.

The Clarksburg soils in Northampton County have a somewhat higher pH than is defined for the series, but this difference does not alter their use, management, or behavior.

Clarksburg soils, the deep and well-drained Duffield and Washington soils, and the moderately deep and well-drained Ryder soils formed in similar material. Clarksburg soils are similar to the Wurtsboro, Phelps, Buchanan, Comly, and Urbana soils in drainage. They have a Bt horizon that the Wurtsboro soils lack. They have a fragipan that the Phelps soils lack. Clarksburg soils lack a sandstone gravel component throughout the solum that is typical of Buchanan soils and the shale component throughout the solum that is typical of the Comly soils. They lack the micaceous component in the lower part of the fragipan that is typical of Urbana soils.

Clarksburg silt loam, 0 to 3 percent slopes (C1A).—This soil is on broad lower toe slopes, in large sinks and flat basins, and in drainageways. The areas generally are long and narrow and range from 3 to 20 acres in size. This soil has the profile described as representative for the series.

Ponding is common where areas occur in depressions, and areas in drainageways are subject to flooding during periods of heavy rainfall and spring thaws. Slow permeability and a seasonal high water table are the major limitations to most uses of this soil. Capability unit IIw-2.

Clarksburg silt loam, 3 to 8 percent slopes (C1B).—This soil is in drainageways, on undulating to karst uplands, and on the lower toe slopes at the base of shale ridges. The areas are generally oval or long and narrow and range from 3 to 30 acres in size.

The profile of this soil is similar to the one described as representative for the series, but the surface layer is thinner, and there are a few small rills caused by erosion. Also, the surface layer commonly contains as much as 12 percent coarse fragments.

The erosion hazard is moderate. In some places areas in drainageways pond during heavy rainfalls and spring thaws. Slow permeability and a seasonal high water table are limitations to most uses of this soil. Capability unit IIe-1.

Comly Series

The Comly series consists of deep, moderately well drained and somewhat poorly drained soils that formed in material weathered from glacial till or from frost-churned, acid, gray shale. These nearly level to gently sloping soils generally are on lower foot slopes, along streams, and in drainageways. Most of the areas occur as bands within areas of better drained soils, and some of these soils and the better drained soils formed in similar material.

In a representative profile the surface layer is very dark grayish-brown silt loam about 9 inches thick. The upper part of the subsoil, between depths of 9 and 26 inches, is yellowish-brown and light olive-brown, heavy silt loam to silty clay loam that has gray, light olive-brown, and yellowish-brown mottles below a depth of 18 inches. The lower part of the subsoil, between depths of 26 and 60 inches, consists of a layer of strong-brown loam that has pinkish-gray mottles over a layer of yellowish-red silt loam that has light brownish-gray, yellowish-brown and light-brown mottles. The subsoil below a depth of 26 inches is firm brittle fragipan.

Comly soils have moderate available moisture capacity. Permeability in the lower part of the subsoil is moderately slow, and the water table is within 1/2 foot to 3 feet of the surface during periods of wetness. Most areas receive runoff from higher elevations.

Some areas of these soils are cropped, some are in pasture and hay, and the rest are idle or wooded. The moderately slow permeability and a seasonal high water table are limitations to most uses.

Representative profile of Comly silt loam, 3 to 8 percent slopes, in a cultivated field south of State Route 946, one-fourth mile west of Danielsville in LeHigh Township:

Ap—0 to 9 inches, very dark grayish-brown (2.5Y 3/2) silt loam; weak, very fine, granular structure; friable, slightly sticky, slightly plastic, 8 percent coarse fragments; neutral; abrupt, wavy boundary.

B21t—9 to 18 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, medium and fine, subangular blocky structure; friable, sticky, plastic; few thin clay films in pores; 5 percent coarse fragments; neutral; abrupt, wavy boundary.

B22t—18 to 26 inches, light olive-brown (2.5Y 5/4) silty clay loam; many, medium, distinct gray (N 6/0), light olive-brown (2.5Y 5/6), and yellowish-brown (10YR 6/4) mottles; weak, thick, platy structure that parts to weak, very fine, blocky; friable, sticky, plastic; common, thin clay films in pores and on ped faces; 5 percent coarse fragments; slightly acid; abrupt, wavy boundary.

Bx1—26 to 32 inches, strong-brown (7.5YR 5/8) loam; many, fine, faint, light pinkish gray (7.5YR 6/2) mottles; weak, coarse, prismatic structure parting to moderate, thin to medium, platy; firm, brittle, sticky, plastic; common thin clay films in pores; 12 percent coarse fragments; medium acid; clear, wavy boundary.

Bx2—32 to 60 inches, yellowish-red (5YR 5/8) silt loam; many, medium, distinct, light brownish-gray (10YR 6/2), yellowish-brown (10YR 5/6), and light-brown (7.5YR 6/4) mottles; weak, coarse, prismatic structure that parts to weak, thin, platy; firm, brittle, sticky, plastic; few thin clay films in pores; 10 percent coarse fragments; slightly acid.

The solum ranges from 42 to 70 inches in thickness. Depth to hard bedrock is more than 4 feet. Depth to the fragipan is 20 to 30 inches. As much as 25 percent of the surface is covered with stones as much as 3 feet in diameter.

The Ap horizon ranges from very dark grayish brown to olive brown. In unplowed areas, the A1 horizon ranges from very dark grayish brown to black. The B21t and B22t horizons range from dark brown to olive yellow. The Bx1 and Bx2 horizons range from silty clay loam to loam, but in many places they are very shaly, gravelly, or cobbly.

The Comly soils in Northampton County have a slightly higher pH in the lower part of the solum than is defined for the series, but this difference does not alter their use, management, or behavior.

Comly soils, the well-drained Berks, Bedington, and Weikert soils, and the poorly drained Brinkerton soils formed in similar material. Comly soils are similar to Volusia, Wurtsboro, Phelps, Buchanan, Urbana, and Clarksburg soils in drainage. They have a Bt horizon that Volusia and Wurtsboro soils lack. They have a fragipan that Phelps soils lack. Comly soils lack a gravel component throughout the solum that is typical of Buchanan soils, and they lack a micaceous component in the fragipan characteristic of Urbana soils. They contain more shale fragments throughout the profile than Clarksburg soils.

Comly silt loam, 0 to 3 percent slopes (CmA).—This soil is in broad, flat upland areas, on toe slopes, in drainageways and potholes, and along small streams. The areas are oval or long and narrow, and range from 2 to 15 acres or more in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is thicker. Ponding occurs where areas are in potholes.

Included with this soil in mapping were areas of soils in which the mottled layer is near the surface and also a few areas of soils that have a higher content of shale in the subsoil than Comly soils.

In cultivated areas this soil is generally near Bedington and Berks soils, and it is managed in the same manner as those soils.

If this Comly soil is artificially drained, it is suited to most crops commonly grown in the county. Alfalfa and winter grains are subject to damage by frost heaving. Capability unit IIw-2.

Comly silt loam, 3 to 8 percent slopes (CmB).—This soil is on broad flat upland areas and toe slopes, in drainageways and potholes, and along small streams. The areas are generally long and narrow or irregular in shape and range from 2 to 25 acres in size. This soil has the profile described as rep-

resentative for the series. If this soil is cultivated, the hazard of erosion is moderate and a few rills or gullies form.

Included with this soil in mapping were several areas where slopes are more than 8 percent.

If erosion-control measures are used and artificial drainage is established, this soil is well suited to most crops commonly grown in the county, except alfalfa, potatoes, and winter grains. Capability unit IIe-1.

Comly extremely stony silt loam, 0 to 8 percent slopes (CnB).—This soil is on smooth or slightly concave uplands that have potholes or depressions in some places. It is generally in swales and drainageways or along small streams. The areas are generally long and narrow or irregular in shape and range from 5 to 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but stones 1 to 3 feet in diameter cover 5 to 25 percent of the surface.

Nearly all of this soil is wooded. This soil is too stony for cultivation. The stones, moderately slow permeability, and seasonal high water table are limitations to many uses. Capability unit VIIs-3.

Conestoga Series

The Conestoga series consists of deep, well-drained, nearly level to very steep soils on uplands. These soils formed in material weathered from micaceous schist, granite, gneiss, and quartzite.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is strong-brown silt loam in the upper 30 inches and friable strong-brown loam at a depth between 38 to 50 inches. The underlying material, at a depth between 50 and 60 inches, is yellowish-brown sandy loam.

Conestoga soils have high available moisture capacity and moderate permeability. Much of the acreage is farmed, but many areas are still wooded. Some areas are used as homesites or are idle.

Representative profile of Conestoga silt loam, 2 to 8 percent slopes, in a cultivated field, 1.2 miles east of Lower Saucon, along Route T406 in Williams Township:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable, nonsticky, nonplastic; 8 percent coarse fragments; slightly acid; abrupt, smooth boundary.

B1—8 to 18 inches, strong-brown (7.5YR 5/6) silt loam; weak, fine, subangular blocky structure; friable, slightly sticky, nonplastic; few, thin, discontinuous clay films in pores; 10 percent coarse fragments; slightly acid; clear, wavy boundary.

B2t—18 to 38 inches, strong-brown (7.5YR 5/8) heavy silt loam; moderate, fine, subangular blocky structure; friable, slightly sticky, slightly plastic; common, thick, continuous clay films in pores; 12 percent coarse fragments; slightly acid; gradual, wavy boundary.

B3—38 to 50 inches, strong-brown (7.5YR 5/6) loam; weak, fine, subangular blocky structure; friable, nonsticky, nonplastic; few, thin, discontinuous clay films in pores; 12 percent coarse fragments; slightly acid; abrupt, wavy boundary.

C—50 to 60 inches, yellowish-brown (10YR 5/6) sandy loam; massive; very friable to loose, nonsticky, nonplastic; 12 percent coarse fragments; neutral.

The solum ranges from 45 to 60 inches in thickness. Depth to hard bedrock is more than 5 feet. The content of mica flakes is high in the B3 and C horizons, where the soil is weathered from schist.

The Ap horizon ranges from yellowish brown to dark grayish brown. In unplowed areas the A1 horizon ranges from very dark gray to dark brown and the A2 horizon ranges from dark grayish brown to yellowish brown. The B2t horizon ranges from strong-brown to yellowish-red silt loam to silty clay loam. In many places the C horizon is saprolite several feet thick that has weak, thin, platy structure.

Conestoga soils, the well-drained Hollinger soils, the moderately well drained Urbana soils, and the poorly drained Baile soils, neutral variant, formed in similar material. Conestoga soils have characteristics similar to those of Bedington, Laidig, Swartswood, Washington, and Duffield soils, but they lack shale throughout the solum that is typical of Bedington soils, and they lack the fragipan of Laidig and Swartswood soils. Conestoga soils contain less clay in the B horizon than Washington soils and less silt than Duffield soils.

Conestoga silt loam, 2 to 8 percent slopes (CoB).—This soil is on broad, smooth, or convex ridgetops and benches. The areas are irregular in shape and range from more than 5 to 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were some areas where the surface layer is thick and areas of soils that have a gravelly surface layer. Also included were about 300 acres, in the extreme southern part of Lower Saucon Township, where the soil is red and gravelly and the subsoil is firm.

This Conestoga soil is suited to all crops commonly grown in the county. It has few limitations to most uses. Capability unit IIe-2.

Conestoga silt loam, 8 to 15 percent slopes (CoC).—This soil is on broad rolling ridgetops and hillsides. The areas range from 5 to more than 100 acres in size. The profile of this soil is similar to the one described as representative for the series, but it is thinner, and has more coarse fragments throughout the profile. The hazard of erosion is moderate to high in cultivated areas. In some areas material from the subsoil has been mixed with that in the plow layer.

Included with this soil in mapping were about 200 acres, in the extreme southern part of Lower Saucon Township, where the soil is red and gravelly and the subsoil is firm.

Conestoga is suited to all crops commonly grown in the county, but if it is cultivated, the hazard of erosion is severe. Sheet and rill erosion are common. Steepness of slope is the major limitation to most nonfarm uses. Capability unit IIIe-1.

Conestoga silt loam, 15 to 25 percent slopes (CoD).—This moderately steep soil is on hillsides and ridges. The areas are adjacent to many of the smaller streams in the county. They generally are long and narrow, and range from 2 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer contains large, coarse fragments, and the surface layer and subsoil combined is thinner. Erosion is moderate to high in cultivated areas.

Included with this soil in mapping were small areas of Hollinger gravelly silt loam and other channery loams and gravelly silt loams and some extremely stony soils in wooded areas. Also included were about 150 acres, in the extreme southern part of Lower Saucon Township, where the soil is red and cobbly.

This Conestoga soil is poorly suited to cultivated crops but is well suited to hay. Steepness of slopes is a limitation to most nonfarm uses. Capability unit IVe-1.

Conestoga and Hollinger extremely stony silt loams, 0 to 8 percent slopes (CrB).—These undulating soils are on smooth hillside benches, on wide ridgetops, and at the base of steep slopes. The areas are generally oval and range from 5 to more than 100 acres in size. Mapped areas consist of Conestoga soil, Hollinger soil, or both. About 75 percent of this unit is Conestoga soil, and about 25 percent is Hollinger soil. The profile of each soil is similar to the one described as representative, for its series, but the surface layer of these soils has not been disturbed by plowing. Stones and boulders are on the surface. Included in mapping were small areas of Stony land.

Most areas of these soils are wooded. Their stony surface layer makes these soils poorly suited to cultivation. Many areas provide scenic sites for residential buildings, but stoniness limits residential development. Capability unit VIIs-3.

Conestoga and Hollinger extremely stony silt loams, 8 to 25 percent slopes (CrD).—These soils are on uneven to smooth hillside benches, on ridgetops, and at the base of steep slopes. The areas are generally oblong and range from 5 to more than 200 acres in size. Mapped areas consist of Conestoga soil, Hollinger soil, or both. About 65 percent of this unit is generally Conestoga soil, and about 35 percent is Hollinger. The profile of each soil is similar to the one described as representative for its series, but the surface layer of these soils has not been disturbed by plowing. Stones and boulders on the surface range from 5 to 25 percent. Included in mapping were small areas of Stony land.

Most areas of these soils are wooded. The stones and steepness of slope make these soils poorly suited to cultivation. Many areas provide scenic sites for residential buildings, but the stones and slope limit residential development. Capability unit VIIs-3.

Conestoga and Hollinger extremely stony silt loams, 25 to 65 percent slopes (CrF).—These soils are on uneven hillsides and ridges. The areas are generally oblong and are 5 to 100 acres in size. Mapped areas consist of Conestoga soil, Hollinger soil, or both. About 50 percent of this unit is generally Conestoga soil, about 25 percent is Hollinger soil, and about 25 percent is less extensive soils and land types. The profile of each soil is similar to the one described as representative for its series, but the surface layer of these soils has not been disturbed by plowing. Stones cover 10 to 25 percent of the surface.

Included with these soils in mapping were small areas of Stony land and Rubble land. Also included were areas of nonstony Hollinger soils and of a red soil that has a cobbly or stony surface. This red soil is in the extreme southern tip of Lower Saucon Township.

Most areas of these soils are wooded (fig. 20). The stones and steepness of slope make these soils poorly suited to cultivation, and they are also limitations to most nonfarm uses. Capability unit VIIs-2.

Figure 20.—A wooded area of Conestoga and Hollinger extremely stony silt loams, 25 to 65 percent slopes.

Conotton Series

The Conotton series consists of deep, well-drained, nearly level to very steep soils. These soils are on gravelly outwash terraces, in valley fill and kames, and on terminal moraines. They formed in stratified glacial drift from many kinds of parent material.

In a representative profile the surface layer is dark-brown gravelly silt loam about 8 inches thick. Between a depth of 8 to 18 inches dark yellowish-brown, gravelly loam from the subsoil is mixed with material from the surface layer. The subsoil, between depths of 18 to 48 inches, is friable, yellowish-brown and strong-brown, gravelly loam or very gravelly loam. The substratum is very gravelly sandy loam that has a high content of gravel and cobblestones and some lime deposits.

Conotton soils have low available moisture capacity and rapid permeability. Most of these soils are farmed, some areas have been quarried for sand and gravel, the rest are idle or wooded.

Representative profile of Conotton gravelly silt loam, 25 to 65 percent slopes, at the intersection of State Legislative Route 48073 and Township Road T697 in Upper Mount Bethel Township:

A1—0 to 8 inches, dark-brown (10YR 3/3) gravelly silt loam; weak, fine, granular structure; very friable, slightly sticky, slightly plastic; 25 percent gravel; slightly acid; clear, wavy boundary.

A&B—8 to 18 inches, dark yellowish-brown (10YR 4/4) gravelly loam; weak, fine, granular structure; friable, nonsticky, nonplastic; 35 percent gravel; in the larger spaces among pebbles, bodies 1/4 inch to 1 inch in diameter of yellowish-brown (10YR 5/4) gravelly loam have dark yellowish-brown (10YR 4/4) coatings on outer surfaces and clay films in pores; medium acid; clear, irregular boundary.

B21t—18 to 28 inches, yellowish-brown (10YR 5/4) very gravelly loam; weak to moderate, fine, granular structure; friable, nonsticky, nonplastic; few thin clay films in pores and clay patches on gravel; 60 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

B22t—28 to 48 inches, strong-brown (7.5YR 5/6) gravelly loam; very weak, fine, subangular blocky structure; friable, slightly sticky, and slightly plastic; thin clay films lining pores; 30 percent gravel and cobblestones; medium acid; clear, wavy boundary.

C—48 to 88 inches, brown (10YR 5/3) very gravelly sandy loam; few, fine, faint, grayish-brown (10YR 5/2) and yellowish-red (5YR 4/8) mottles; very weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; very firm, slightly sticky, slightly plastic; few, thin, clay films in the pores; common deposits of secondary calcium carbonate on coarse fragments; 65 percent gravel and cobblestones; many limestone ghosts; slightly acid.

The solum ranges from 40 to 72 inches in thickness. Depth to hard bedrock is more than 5 feet. Coarse fragments in the A1 horizon are mainly gravel, but in some places there are channery fragments. Inclusions of B horizon material in the A and B horizons range from 5 to 25 percent, by volume. The B21t and B22t horizons range from gravelly and sandy loam and very gravelly sandy loam to sandy clay loam. The coarse fragment content in the B horizon ranges to more than 35 percent. The C horizon contains many cobblestones, stones, or channery fragments in some areas.

Conotton soils, the moderately well drained Phelps soils, the somewhat poorly drained Red Hook soils, and the very poorly drained Halsey soils formed in similar material. Conotton soils have characteristics similar to those of Barbour soils, but they have a Bt horizon, which Barbour soils lack.

Conotton gravelly silt loam, 0 to 3 percent slopes (CtA).—This soil is on smooth, uniform, glacial outwash terraces and on the flat tops of kames. The areas range from 2 to more than 200 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is thicker. In most areas the erosion hazard is slight, and soil losses are negligible.

Included with this soil in mapping were some areas where the content of gravel in the surface layer is less than 15 percent and small areas of soils that have a firm, brittle layer in the subsoil. Also included were areas of Conotton soils (along the Delaware River, between Martins Creek and Riverton) that have higher available moisture capacity and more flat coarse fragments than Conotton soils in other parts of the county.

This soil is suited to all crops commonly grown in the county, but crops that have a high moisture requirement are affected by a moisture shortage in dry years.

Most of this Conotton soil is cultivated or is used for residential or industrial developments. If onsite sewage disposal is used, there is a hazard of ground water contamination by unfiltered effluent. Capability unit IIs-1.

Conotton gravelly silt loam, 3 to 8 percent slopes (CtB).—This soil is on smooth or slightly convex outwash terraces and kames. It is slightly karstic in some areas. The areas are irregular in shape and range from 5 to more than 250 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is thicker. In most areas erosion hazard is slight, and soil losses are negligible.

Included with this soil in mapping were areas where depth to bedrock is less than 4 feet and areas of soils that have a firm brittle layer in the subsoil. Also included were areas of soils that have less than 15 percent gravel in the surface layer and areas of soils, along small streams, that have less than 35 percent gravel in the subsoil. Another inclusion is areas of Conotton soils (along the Delaware River, between Martins Creek and Riverton) that have higher available moisture capacity and more flat coarse fragments than Conotton soils in other parts of the county.

This soil is suited to all crops commonly grown in the county, but crops that have a high moisture requirement are affected by a moisture shortage in dry years.

Most of this Conotton soil is cultivated or is developed for residential or industrial use. If onsite sewage disposal is used, there is a hazard of ground-water contamination by unfiltered effluent. Capability unit IIs-1.

Conotton gravelly silt loam, 8 to 15 percent slopes (CtC).—This soil is on short convex escarpments and kames. The areas are irregular in shape and range from 2 to 25 acres in size. The profile of this soil is similar to the one described as representative for the series, but in many places the subsoil is coarser textured, and evidence of sheet and rill erosion is common. In some areas part of the material from the subsoil is mixed with that in the plow layer, and the surface layer is completely altered.

Included with this soil in mapping were areas where bedrock is at a depth of less than 4 feet, and areas that have a firm, brittle layer in the subsoil. Also included were areas of soils along smaller streams that have less than 35 percent gravel in the subsoil.

If this soil is protected from erosion, it is suited to most crops commonly grown in the county.

Most of this soil is cultivated or is idle, but some areas are wooded or in pasture. If onsite sewage disposal systems are used, there is a hazard of ground-water contamination by unfiltered effluent. Capability unit IIIe-2.

Conotton gravelly silt loam, 15 to 25 percent slopes (CtD)—This soil is on short and moderately long convex escarpments and kames. The areas are generally from 2 to 25 acres in size. Rills and small gullies are common. In some areas a

part of the material from the subsoil is mixed with that in the plow layer.

Included with this soil in mapping were areas of Swartswood gravelly loam, a few steep stony areas, and a few areas of cobbly sandy loams and gravelly sandy loams.

This Conotton soil is poorly suited to cultivated crops, but it is suited to long-term hay, orchard, or pasture. If this soil is cultivated, the erosion hazard is very high. Steepness of slope is the major limitation for most nonfarm uses. Capability unit IVe-1.

Conotton gravelly silt loam, 25 to 65 percent slopes (CtF).—This soil is on smooth, abrupt escarpments and kames that generally are near major drainageways. The areas are long and narrow and range from 2 to 25 acres in size. This soil has the profile described as representative for the series. The erosion hazard is very high on cleared areas. Most areas have a permanent vegetative cover and are not subject to erosion.

Included with this soil in mapping were areas of soils that have a cobbly or stony surface layer and areas of soils that formed in glacial till. These till areas generally have a firm, brittle layer in the subsoil.

This Conotton soil is too steep for cultivated crops, hay, or improved pasture. Steepness of slope is the major limitation to most nonfarm uses. Capability unit VIIe-1.

Duffield Series

The Duffield series consists of deep, well-drained, nearly level to gently sloping soils on uplands. These soils formed in material weathered mostly from bluish-gray, impure limestone commonly called cement rock. The topography is smooth or undulating.

In a representative profile the surface layer is dark-brown silt loam about 10 inches thick. The upper part of the subsoil is brown, very friable silt loam about 6 inches thick. The lower part of the subsoil, below a depth of 16 inches, is friable, yellowish-brown and dark yellowish-brown silt loam that extends to a depth of 60 inches. The substratum, between depths of 60 to 72 inches, is brown, channery silt loam.

Duffield soils have high available moisture capacity and moderate permeability. Most of the acreage of these soils is farmed or is used for industrial or residential development.

Representative profile of Duffield silt loam, 3 to 8 percent slopes, in a cultivated field, 600 feet north of the intersection of State Routes 987 and 329 in East Allen Township:

Ap—0 to 10 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; very friable, nonsticky, nonplastic; 2 percent coarse fragments; neutral; abrupt, wavy boundary.

B1—10 to 16 inches, brown (10YR 4/3) silt loam; moderate, medium, subangular blocky structure; very friable, nonsticky, nonplastic; neutral; clear, wavy boundary.

B21t—16 to 36 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium and coarse, subangular blocky structure; friable, slightly sticky, slightly plastic; common thin clay films on peds and in pores; neutral; clear, wavy boundary.

B22t—36 to 60 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, coarse, subangular blocky structure; friable, slightly sticky, slightly plastic; few thin clay films on peds; 10 percent channery limestone fragments; slightly acid; clear, wavy boundary.

C—60 to 72 inches, brown (10YR 4/3) channery silt loam; weak, coarse, subangular blocky structure; friable, nonsticky, nonplastic; 20 percent channery limestone fragments; slightly acid.

The solum ranges from 48 to 70 inches in thickness. Depth to hard bedrock ranges from more than 5 to 10 feet.

The B horizon ranges from 50 to 75 percent in content of silt. The B1, B21t, and B22t horizons have a coarse fragment content of less than 15 percent. The C horizon has a coarse fragment content that ranges from 15 to 35 percent.

The Duffield soils in Northampton County have a slightly higher pH value below a depth of 50 inches than is defined for the series, but this difference does not alter their use, management, or behavior.

Duffield soils, the moderately deep, well-drained Ryder soils, and the moderately well drained Clarksburg soils formed in similar material. Duffield soils have characteristics similar to those of the Washington, Conestoga, and Bedington soils, but they have a higher content of silt than the Washington and Conestoga soils, and they lack the shaly component of Bedington soils.

Duffield silt loam, 0 to 3 percent slopes (DuA).—This soil is on broad, smooth upland areas. The areas generally are oval and range from 3 to more than 25 acres in size.

Included with this soil in mapping were small moderately well drained areas. Also included were areas where soil material eroded from higher areas and was accumulated on the surface. In many places this material is as much as 2 feet deep.

This soil is well suited to all crops commonly grown in the county. The erosion hazard is slight. It has few limitations to most nonfarm uses. Capability unit I-1.

Duffield silt loam, 3 to 8 percent slopes (DuB).—This soil is on broad, smooth, or undulating uplands that dominantly have a southern exposure. The areas range from 5 to more than 40 acres in size. This soil has the profile described as representative for the series. The erosion hazard is moderate.

This Duffield soil is suited to all crops commonly grown in the county. It has few limitations to most nonfarm uses. Capability unit IIe-2.

Halsey Series

The Halsey series consists of deep, nearly level, very poorly drained soils in depressions and along drainageways on outwash terraces, valley fills, and terminal moraines. These soils formed in stratified glacial drift derived from many kinds of material.

In a representative profile the surface layer is black silt loam about 9 inches thick. The upper part of the subsoil, between a depth of 9 and 14 inches, is firm, gray silty clay loam that has many yellowish-brown mottles. The lower part of the subsoil is 20 inches of gray, firm, gravelly loam and dark-gray very gravelly loam. The substratum, below a depth of 34 inches, is very gravelly loam that has a high content of cobblestones and pebbles.

These soils have a moderate available moisture capacity and moderately slow permeability. Water ponds on the surface during most of the year.

Most areas of these soils are idle, but some are in pasture. In a small acreage, quarries, land fills, and other nonfarm uses have altered the soils. A high water table, moderately slow permeability, and ponding are major limitations to most uses.

Representative profile of Halsey silt loam in a pasture three-fourths of a mile northeast of Five Points in Upper Mount Bethel Township:

Ap1—0 to 5 inches, black (10YR 2/1) silt loam, gray (10YR 5/1) when dry and crushed; weak, medium, granular structure; friable, nonsticky, nonplastic; 5 percent coarse fragments; neutral; abrupt, smooth boundary.

Ap2—5 to 9 inches, black (10YR 2/1) silt loam, dark gray (10YR 4/1) when dry and crushed; moderate, medium, subangular blocky structure; friable, nonsticky, nonplastic; common dark-red (2.5YR 3/6) iron coatings and stains throughout; 10 percent coarse fragments; neutral; abrupt, smooth boundary.

IIB21g—9 to 14 inches, gray (N 5/1) silty clay loam; many, coarse, prominent, yellowish-brown (10YR 5/8) mottles; weak, coarse, prismatic structure that parts to moderate, medium, blocky;

firm, slightly sticky and plastic; thin, discontinuous silt and clay films in cracks and pores; 10 percent coarse fragments; neutral; abrupt, smooth boundary.

IIIB22g—14 to 28 inches, gray (N 5/0) gravelly loam; weak, coarse, prismatic structure parting to moderate, coarse, blocky; firm, slightly sticky, slightly plastic; thin, continuous clay films on peds and in pores; 30 percent coarse fragments; neutral; clear, smooth boundary.

IIIB3g—28 to 34 inches, dark-gray (N 4/0) very gravelly loam; weak, coarse, prismatic structure that parts to moderate, medium, blocky; firm, slightly sticky, slightly plastic; thin, discontinuous clay films on peds and in pores; 65 percent coarse fragments; some free carbonates below 36 inches; mildly alkaline; clear, smooth boundary.

IIIC—34 to 50 inches, dark-gray (N 4/0) very gravelly sandy loam; massive; firm, nonsticky, nonplastic; 75 percent coarse fragments; free carbonates on gravel and cobblestones; moderately alkaline.

The solum ranges from 24 to 34 inches in thickness. Depth to bedrock is more than 6 feet. Mottles of yellowish brown, strong brown, light olive brown, and brown are common in the IIB21g horizon. The IIIB22g horizon ranges from silt loam to gravelly loam. The substratum below a depth of 6 feet is stratified sand and gravel that ranges from loose to firm.

The Halsey soils in Northampton County differ from typical Halsey soils in that they have a layer of silty clay loam in the upper part of theB horizon and generally are slightly more than 18 percent clay, by weight, in the upper 40 inches, but these differences do not affect their use, management, or behavior.

Halsey soils, the well-drained Conotton soils, the moderately well drained Phelps soils, thick solum variant, and the somewhat poorly drained Red Hook soils formed in similar material. Halsey soils are similar to Chippewa soils in drainage, but they lack the fragipan typical of those soils.

Halsey silt loam (0 to 2 percent slopes) (Ha).—This is the only Halsey soil mapped in the county. It is in drainageways, potholes, and closed depressions. The areas are round, oval, or long and narrow. They range from 2 to 30 acres in size, and they are ponded for long periods. Including in mapping were some gravelly, cobbly, or stony areas.

Because of ponding, this soil is generally poorly suited to crops. The areas are low lying, and drainage outlets are difficult to establish. Capability unit IVw-2.

Hollinger Series

The Hollinger series consists of deep, well-drained, nearly level to very steep soils on uplands. These soils formed in material weathered from micaceous schist, granite, gneiss, and quartzite.

In a representative profile the surface layer is dark grayish-brown gravelly silt loam about 8 inches thick. The subsoil is yellowish-brown, friable, gravelly silt loam about 16 inches thick. The underlying material, at a depth between 24 and more than 50 inches, is light yellowish-brown, very channery loam.

Hollinger soils have moderate available moisture capacity and moderate permeability.

Many areas are farmed, but some are too stony for cultivated crops. The high content of coarse fragments is a limitation to most uses.

Representative profile of Hollinger gravelly silt loam, 8 to 15 percent slopes, in an idle field, 1.3 miles north of Lower Saucon in Lower Saucon Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; moderate, fine, granular structure; friable, nonsticky, nonplastic; 20 percent coarse fragments; neutral; clear, smooth boundary.

B2t—8 to 24 inches, yellowish-brown (10YR 5/4) gravelly silt loam; moderate, fine, subangular blocky structure; friable, slightly sticky, nonplastic; few, thin, discontinuous clay films on peds and lining pores; 15 percent coarse fragments; neutral; clear, smooth boundary.

C—24 to 50 inches, light yellowish-brown (10YR 6/4) very channery loam; very weak, fine, granular structure largely obscured by coarse fragments; very friable to loose, nonsticky, nonplastic; 75 percent coarse fragments; neutral.

The solum ranges from 20 to 40 inches in thickness. Depth to hard bedrock is more than 4 feet. The gravel or channery fragment content in the Ap horizon ranges from 15 to 30 percent and from 10 to 50 percent in the B2t horizon. These fragments are generally gneiss, but quartz is common where the underlying rock is quartzite.

The Ap horizon ranges from yellowish brown to dark grayish brown. The A1 horizon, where present, ranges from very dark gray to dark brown. The A2 horizon, where present, ranges from dark grayish brown to yellowish brown. The B2t horizon ranges from yellowish brown to dark brown in color and from gravelly silt loam to gravelly loam in texture.

Hollinger soils, well-drained Conestoga soils, the moderately well drained Urbana soils, and the poorly drained Baile soils, neutral variant, formed in similar material. The solum of Hollinger soils is not so thick as that of those soils. Hollinger soils have a solum that is similar to that of the Berks and Ryder soils in thickness. They are deeper over bedrock than the Berks and Ryder soils.

Hollinger gravelly silt loam, 3 to 8 percent slopes (HnB).—This soil is on uniform, smooth, or undulating uplands and ridgetops. The areas range from 5 to more than 100 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer and the subsoil combined are thicker.

Included with this soil in mapping were small areas of soils where the surface layer and subsoil combined are less than 20 inches thick.

This soil is suited to all crops commonly grown in the county, but in some places coarse fragments interfere with cultivation. It tends to be somewhat droughty. The erosion hazard is moderate. The main limitation to most uses is the many coarse fragments on the surface. Capability unit IIe-2.

Hollinger gravelly silt loam, 8 to 15 percent slopes (HnC).—This soil is on irregularly shaped ridgetops and hillsides. The areas range from 5 to more than 100 acres in size. The profile of this soil is the one described as representative for the series. Erosion is moderate to high in cultivated areas.

Included in mapping were areas of soils where the surface layer and the subsoil combined are less than 20 inches thick.

This soil is suited to all crops commonly grown in the county, but if it is cultivated, the erosion hazard is severe. The main limitation to most uses is slope and the many coarse fragments on the surface. Capability unit IIIe-1.

Hollinger gravelly silt loam, 15 to 25 percent slopes (HnD).—This soil is on irregularly shaped hills and ridges, mostly in the vicinity of small drainageways. The areas range from 2 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but it is thinner and has a higher percentage of coarse fragments throughout. The hazard of erosion is moderate to very high in cultivated areas.

Included with this soil in mapping were a few areas of soils where the surface layer and the subsoil combined are less than 20 inches thick.

This Hollinger soil is poorly suited to cultivated crops, but is well suited to long-term hay, orchards, and pasture. Steep slopes are a limitation to most nonfarm uses. Capability unit IVe-1.

Holly Series

The Holly series consists of deep, nearly level, poorly drained to very poorly drained soils that are on flood plains along most of the perennial streams in the county. These

soils formed in mixed alluvial material deposited by streams that flowed through areas of many kinds of soils.

In a representative profile the surface layer is dark-gray silt loam about 9 inches thick. The subsoil is dark-brown and dark-gray silt loam 31 inches thick and has dark reddish-brown mottles. The subsoil is friable and the content of clay increases in the lower part. The substratum, between a depth of 40 and 68 inches, is dark-gray loam and sandy loam that has distinct, dark reddish-brown mottles.

These soils are commonly along the smaller streams and are subject to flooding. Water stands on the surface for short periods during heavy rains or after spring thaw. These soils have high available moisture capacity and moderate permeability.

Most areas are idle, wooded, or used for pasture. Very little of the acreage is tilled. If these soils are artificially drained, they are suited to most crops commonly grown in the county. Susceptibility to flooding and a high water table are the major limitations to most nonfarm uses.

Representative profile of Holly silt loam, in an idle field adjacent to Thomas Island, along State Legislative Route 48073 in Upper Mount Bethel Township:

Ap—0 to 9 inches, dark-gray (10YR 4/1) silt loam; common, fine, distinct, yellowish-brown (10YR 5/8) and dark reddish-brown (5YR 3/4) mottles; weak, medium and coarse, granular structure; friable, nonsticky, nonplastic; medium acid; abrupt, wavy boundary.

B1—9 to 24 inches, dark-brown (7.5YR 4/2) silt loam; common, fine, distinct, dark reddish-brown (5YR 3/3) mottles; weak, coarse, subangular blocky structure; friable, nonsticky, nonplastic; common iron and manganese concretions; slightly acid; clear, wavy boundary.

B2—24 to 40 inches, dark-gray (10YR 4/2) heavy silt loam; few, fine, distinct, dark reddish-brown (5YR 3/4) mottles; weak, medium and coarse, prismatic structure that parts to weak, coarse, subangular blocky; friable, slightly sticky, slightly plastic; slightly acid; clear, wavy boundary.

IIC1—40 to 56 inches, dark-gray (10YR 4/1) loam; many, medium, distinct, dark reddish-brown (5YR 3/4) mottles; weak, medium and coarse, prismatic structure that parts to weak, coarse, subangular blocky; friable, nonsticky, nonplastic; neutral; clear, wavy boundary.

IIC2—56 to 68 inches, dark-gray (10YR 4/1) sandy loam; many, coarse, distinct, dark reddish-brown (2.5YR 3/4) mottles; weak, medium and coarse, prismatic structure parting to weak, coarse, subangular blocky; friable, nonsticky, nonplastic; slightly acid.

Depth to mottles ranges from 0 to 6 inches. Depth to bedrock is more than 5 feet. Content of coarse fragments at a depth of 40 inches ranges from 0 to 20 percent.

The Ap horizon ranges from very dark gray to dark grayish brown. The B1 and B2 horizons range from silt loam to silty clay loam in texture and vary widely in color, depending upon the origin of the sediment in which they formed. The IIC1 and IIC2 horizons range from dark gray to dark grayish brown in color, and the texture is loam or sandy loam. In many places the IIC1 and IIC2 horizons contain shale chips, gravel, and cobblestones.

Holly soils, the well-drained Barbour soils, and the moderately well drained to somewhat poorly drained Middlebury soils formed in similar material. Holly soils have a finer texture throughout the B horizon than Red Hook soils, which are on low terraces.

Holly silt loam (0 to 3 percent slopes) (Ho).—This is the only Holly soil mapped in the county. Areas are long, narrow, and irregular in shape. They range from 2 to 25 acres in size.

Included with this soil in mapping were areas of soils that commonly have gravel, shale chips, and cobblestones throughout the profile. These soils are mainly along the small streams at or near the toe slopes of Blue Mountain.

Because of susceptibility to flooding and wetness, this Holly soil is suited to cultivated crops. Winter heaving of alfalfa and small grains is severe. Susceptibility to flooding and a high water table are limitations to most nonfarm uses. Capability unit IVw-1.

Laidig Series

The Laidig series consists of deep, well-drained, nearly level to very steep soils. These soils formed in colluvial or glacially influenced material weathered from sandstone, conglomerate, quartzite, and shale.

In a representative profile a mat of leaf litter 1 inch thick is over a surface layer of black, highly organic silt loam about 2 inches thick. The subsurface layer is gray loam about 1 inch thick. The upper part of the subsoil, between depths of 3 and 40 inches, is yellowish-brown, gravelly silt loam, clay loam, and gravelly sandy clay loam that has a few, faint, yellowish-brown and light yellowish-brown mottles in the lower part. The lower part of the subsoil, between depths of 40 and 70 inches, is a very firm gravelly loam fragipan that contains distinct mottles. The substratum, beginning at a depth of 70 inches, is a firm and brittle cobbly sandy loam fragipan. It is about 45 percent gravel, cobblestones, and channery fragments.

Permeability in the fragipan is moderately slow. Available moisture capacity is moderate.

Laidig soils mapped in Northampton County are extremely stony and are poorly suited to most uses.

Representative profile of Laidig silt loam in an area of Laidig extremely stony silt loam, 8 to 25 percent slopes, southwest of the Pen Argyl High School athletic fields:

O1—1 inch to 0, recently deposited deciduous leaf litter, somewhat decomposed.

A1—0 to 2 inches, black (10YR 2/1) silt loam; weak, fine, granular structure; friable, nonsticky, nonplastic; 10 percent gravel up to 2 inches in diameter; peds somewhat bound together by roots and partially decomposed organic fibers; 25 percent stones 1 to 3 feet in diameter; slightly acid; abrupt, irregular boundary.

A2—2 to 3 inches, gray (10YR 5/1) loam; weak, fine and medium, granular structure; very friable, nonsticky, nonplastic; 8 percent gravel; 25 percent stones 1 to 3 feet in diameter; strongly acid; abrupt, irregular boundary.

B1—3 to 16 inches, yellowish-brown (10YR 5/6) gravelly silt loam; moderate, fine and medium, subangular blocky structure; friable, slightly sticky, slightly plastic; 18 percent gravel; medium acid; abrupt, wavy boundary.

B21t—16 to 28 inches, yellowish-brown (10YR 5/8) clay loam; strong, fine and medium, subangular blocky structure; friable, sticky, plastic; 12 percent gravel; thin clay films on ped faces; medium acid; abrupt, wavy boundary.

B22t—28 to 40 inches, yellowish-brown (10YR 5/8) gravelly sandy clay loam; few, fine, faint yellowish-brown (10YR 5/4) and light yellowish-brown (2.5Y 6/4) mottles; weak, thick, platy structure that parts to moderate, very fine, subangular blocky; firm, slightly sticky, slightly plastic; 18 percent gravel; few clay films in pores; many iron and manganese concretions; medium acid; abrupt, wavy boundary.

Bx—40 to 70 inches, strong-brown (7.5YR 5/6) gravelly loam; many, medium, distinct, strong-brown (7.5YR 5/8), light brownish-gray (2.5Y 6/2), and yellowish-brown (10YR 5/4) mottles; weak, very thick, platy structure that parts to weak, fine and medium, subangular blocky; very firm, brittle, slightly sticky, slightly plastic; thick clay films in pores; 25 percent gravel and cobblestones; common iron and manganese concretions; medium acid; abrupt, smooth boundary.

Cx—70 to 80 inches, strong-brown (7.5YR 5/8) cobbly sandy loam; few, fine, distinct, yellowish-brown (10YR 5/4), light brownish-gray (2.5Y 6/2), and strong-brown (7.5YR 5/6) mottles; weak, medium and thick, platy structure; firm, brittle, slightly sticky, slightly plastic; thick clay film patches on peds and in pores; 45 percent gravel, cobblestones, and channery fragments; medium acid.

The solum is more than 4 feet thick. Depth to hard bedrock is more than 5 feet. Depth to fragipan ranges from 2 1/2 to 4 feet. As much as

25 percent coarse fragments larger than 10 inches are present throughout the profile.

The B1, B21t, and B22t horizons range from brown to brownish yellow. These horizons range from silt loam to sandy clay loam and have as much as 30 percent gravel, channery fragments, and cobblestones. The fragipan ranges from strong brown to yellowish brown. Texture of the fine soil fraction ranges from sandy loam to clay loam that has as much as 60 percent gravel, channery fragments, and cobblestones.

Laidig soils in Northampton County have a somewhat higher pH than is defined for the series, but this difference does not alter their use, management, or behavior.

Laidig soils, the moderately well drained to somewhat poorly drained Buchanan soils, and the poorly drained Andover soils formed in similar material. Laidig soils have characteristics similar to those of the Bedington and Swartswood soils, but Bedington soils lack a fragipan, and Swartswood soils lack a Bt horizon.

Laidig extremely stony silt loam, 0 to 8 percent slopes (LaB).—Areas of this soil are long and narrow and irregular in shape. They range from 5 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but the dark-colored surface layer is thicker and the mottles in the subsoil are nearer the surface. Stones cover 10 to 25 percent of the surface. On the toe slopes of Blue Mountain, this soil is finer textured, is much deeper to bedrock, and has a thicker fragipan than Laidig soils on the sides of or on the top of the mountain.

Included with this soil in mapping were areas of soils on the upper part of mountainsides and on the mountaintop that are only moderately deep to bedrock, have a high content of coarse fragments, and lack a fragipan. Also included were small, wet areas or potholes, steep escarpments, and areas where stones cover 25 to 50 percent of the surface. Areas of Stony land, and Rubble land were also included.

Because of its extremely stony surface, this soil is generally better suited to unimproved pasture or woodland than to other uses. Capability unit VIIs-3.

Laidig extremely stony silt loam, 8 to 25 percent slopes (LaD).—Areas of this soil are long and narrow and irregular in shape. They range from 5 to more than 50 acres in size. This soil has the profile described as representative for the series. Stones cover 10 to 25 percent of the surface. On the toe slopes of Blue Mountain, this soil is finer textured, much deeper to bedrock, and has a thicker fragipan than Laidig soils on the mountainsides or on mountaintops. Toe slope cuts 20 to 40 feet deep that do not expose bedrock are common where major roads cross Blue Mountain.

Included with this soil in mapping were areas of soils on the upper part of the mountainsides and on the mountaintop that are only moderately deep to bedrock, have a high content of coarse fragments, and lack a fragipan. Also included were small areas of Buchanan extremely stony silt loam. Other inclusions were small areas where slopes are more than 25 percent, some soils in potholes and depressions where slopes are less than 8 percent, areas where stones cover 25 to 50 percent of the surface, areas of Stony land, and areas of Rubble land.

Steepness of slope and the extremely stony surface are limitations to most uses. Capability unit VIIs-3.

Laidig extremely stony silt loam, 25 to 65 percent slopes (LaF).—The areas of this soil are long and narrow and irregular in shape. They range from 10 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but it has a somewhat coarser textured subsoil, and a less firm fragipan, and in many places hard bedrock is at a depth of 5 to 6 feet.

Included with this soil in mapping were areas of soils that lack a fragipan, areas where stones cover 25 to 50 percent of the surface, and areas that are moderately deep and have a weak fragipan. Also included were small areas where slopes are less than 25 percent, areas of Stony land, and areas of Rubble land.

Steepness of slope and the extremely stony surface are limitations to most uses. Capability unit VIIs-2.

Middlebury Series

The Middlebury series consists of deep, moderately well drained and somewhat poorly drained soils on flood plains along perennial streams. These nearly level soils formed in mixed alluvial material deposited by streams which flowed through areas of many kinds of soils.

In a representative profile the surface layer is brown sandy loam about 10 inches thick. The upper 10 inches of the subsoil is friable, dark yellowish-brown silt loam. Between depths of 20 and 27 inches, the subsoil is dark yellowish-brown loam that has dark-brown and very dark grayish-brown mottles. The upper part of the substratum, between depths of 27 and 32 inches, is dark grayish-brown loam that has dark-brown and gray mottles. The substratum, between depths of 32 and 42 inches, is gray coarse sandy loam. Below a depth of 42 inches, the substratum is dark-gray loamy sand that extends to a depth of more than 50 inches.

Middlebury soils have moderate permeability and moderate moisture capacity. A high water table is between depths of 1 and 2 1/2 feet during wet periods. Although Middlebury soils are subject to flooding in some places, many areas are above yearly overflow levels. These soils are suited to most crops commonly grown in the county. Many areas of this soil are farmed; a few areas are urbanized; the rest of the areas are in pasture, are idle, or are wooded. Flooding and a seasonal high water table are limitations to most nonfarm uses.

Representative profile of Middlebury sandy loam in a pasture, in an area of Middlebury soils along Frya Run, west of State Legislative Route 48006 in Williams Township:

A1—0 to 10 inches, brown (10YR 4/3) sandy loam; weak, medium, and coarse, granular structure; friable, nonsticky, nonplastic; slightly acid; gradual, wavy boundary.

B1—10 to 20 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium and coarse, granular structure; friable, slightly sticky, slightly plastic; neutral; gradual, wavy boundary.

B2—20 to 27 inches, dark yellowish-brown (10YR 4/4) loam; few, fine, faint, dark-brown (7.5YR 4/4) and very dark grayish-brown (10YR 3/2) mottles; weak, medium, subangular blocky structure; firm, slightly sticky, slightly plastic; neutral; abrupt, smooth boundary.

C1g—27 to 32 inches, dark grayish-brown (10YR 4/2) loam; many, medium, distinct, dark-brown (7.5YR 4/4) and gray (10YR 6/1) mottles; massive; friable, slightly sticky, slightly plastic; slightly acid; abrupt, smooth boundary.

C2g—32 to 42 inches, gray (10YR 5/1), coarse sandy loam; many, medium and coarse, distinct, strong-brown (7.5YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; massive, friable, slightly sticky, slightly plastic; neutral; abrupt, smooth boundary.

C3g—42 to 50 inches, dark-gray (N 4/0) loamy sand; single grain; very friable to loose, nonsticky, nonplastic; 2 percent gravel; neutral.

Depth to mottles ranges from 12 to 30 inches. Depth to bedrock is more than 4 feet.

The A1 horizon ranges from very dark grayish brown to dark brown in color and from silt loam to sandy loam in texture. The B2, C1g, and C2g horizons range from coarse sandy loam to sandy clay loam. The C3g horizon ranges from sandy loam to sand and contains varying amounts of gravel and cobblestones.

Middlebury soils, the well-drained Barbour soils, and the poorly drained to very poorly drained Holly soils formed in similar alluvial material. Middlebury soils are similar to Phelps soils, thick solum variant, but they lack the Bt horizon of those soils.

Middlebury soils (0 to 3 percent slopes) (Mb).—These are the only Middlebury soils mapped in the country. They are on smooth or slightly concave flood plains. The areas are long and narrow. They range from 2 to 15 acres in size. The surface layer ranges from silt loam to sandy loam.

Included with these soils in mapping were areas of soils that are more silty throughout the profile than typical Middlebury soils. These areas are mainly along streams that drain limestone and shale uplands. Also included were areas of Middlebury soils, along small streams that flow from the base of Blue Mountain, that contain gravel and cobblestones.

Middlebury soils are suited to most crops commonly grown in the county, but winter frost damages alfalfa and winter grains. Moderate available moisture capacity is a limitation during dry periods, but some areas are near streams and irrigation is feasible. Flooding is the main limitation to most uses. The frequency and regularity of flooding vary from one area to another, and onsite investigation is needed to determine the severity of the flooding hazard. Capability unit IIw-1.

Muck

Muck consists of organic material, 2 1/2 to many feet thick, in bogs and swamps. The organic material is derived from rushes, sedges, moses, and woody vegetation, and it overlies glacial drift. In recent geologic time, glaciers dammed up streams and formed depressions in which water was trapped. Organic material accumulated in these depressions, and decomposition of the upper 12 to 24 inches formed a muck surface layer.

The water table is near the surface, but it fluctuates enough to permit the decomposition of the upper 12 to 24 inches of the organic deposits. The lower peat layers are saturated, and decomposition is very slow. The peat layers are underlain by mineral soil material. Depth to hard bedrock is more than 6 feet.

The areas of Muck are not cultivated. In its natural state, Muck provides good habitat for muskrat and waterfowl. The vegetation consists of reeds, sedges, alders, and a few scrubby red maples. Some areas are flooded by overflow from streams.

Muck is near areas of the poorly to very poorly drained Halsey soils and the poorly drained Chippewa and Holly soils.

Muck (0 to 1 percent slopes) (Mu).—This is the only unit of Muck mapped in the county. Included in mapping were areas of Halsey soils.

The major limitations to use are a high water table and the subsidence that takes place if it is excessively drained. Muck is not suitable for building sites, but it must be removed or displaced before roads, embankments, or other structures are built. Muck can be used for the commercial production of peat products for plants in gardens and greenhouses. Capability unit VIIw-1.

Phelps Series, Thick Solum Variant

The Phelps series, thick solum variants, consists of deep, moderately well drained, gently sloping soils. These soils are on gravelly outwash terraces, valley fill, kames, and low stream terraces. They formed in stratified glacial drift composed of many kinds of parent material.

In a representative profile the surface layer is thin, very dark grayish-brown, gravelly silt loam over a grayish-brown, fine sandy loam subsurface layer. The combined thickness of these layers is about 10 inches. The upper part of the subsoil is brown silt loam and silty clay loam that has strong-brown and pinkish-gray mottles below a depth of 18 inches. The upper part of the subsoil is friable and is about 14 inches thick. The lower part of the subsoil, between depths of 24 to 52 inches, is gray gravelly sandy clay loam that has yellowish-red and strong-brown mottles, over gray sandy clay loam that has yellowish-red and brown mottles. The substratum, below a depth of 52 inches and extending to a depth of more than 70 inches, consists of layers of coarse sand and gravelly fine sandy loam that have mottles of pinkish gray, dark grayish brown, gray and red.

Permeability of the subsoil is moderately slow, and available moisture capacity is moderate. The water table is between a depth of 1 1/2 to 3 feet during wet periods. Areas in depressions are subject to ponding during heavy rains or spring thaws.

Some areas of these soils are used as building sites, gravel quarries and canals, and for industrial development, but most of them are cultivated or are wooded. The cultivated areas are commonly farmed in the same manner as the closely associated Conotton soils. Some areas are used for pasture or are idle.

These soils are suited to most crops commonly grown in the county; alfalfa and winter grains, however, are affected by winterkilling. Moderately slow permeability of the subsoil and the seasonal high water table are major limitations to most nonfarm uses.

Representative profile of Phelps gravelly silt loam, thick solum variant, 2 to 8 percent slopes, in woodland, 1.3 miles northwest of Johnsonville in Upper Mount Bethel Township.

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam; moderate, fine, granular structure; friable, nonsticky, nonplastic; 15 percent coarse fragments; medium acid; abrupt, wavy boundary.

A2—4 to 10 inches, grayish-brown (10YR 5/2) fine sandy loam; weak, fine, subangular blocky structure; friable, nonsticky, nonplastic; 2 percent coarse fragments; strongly acid; clear, irregular boundary.

B1—10 to 18 inches, brown (10YR 5/3) heavy silt loam; weak, medium, platy structure parting to very fine, subangular blocky; friable, slightly sticky, slightly plastic; 5 percent coarse fragments; strongly acid; clear, wavy boundary.

B21t—18 to 24 inches, brown (10YR 5/3) silty clay loam; many, coarse, distinct mottles of strong brown (7.5YR 5/8) and pinkish gray (7.5YR 6/2); moderate, fine, blocky structure; friable, sticky, plastic; few, thin clay films in the larger pores; 2 percent coarse fragments; medium acid; abrupt, wavy boundary.

IIB22g—24 to 36 inches, gray (10YR 6/1) gravelly sandy clay loam; many, medium, prominent mottles of yellowish red (7.5YR 5/8) and strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; friable, slightly sticky, slightly plastic; 20 percent coarse fragments as much as 5 inches in diameter; strongly acid; clear, wavy boundary.

IIB23g—36 to 52 inches, gray (10YR 6/1) sandy clay loam; many, coarse, prominent mottles of yellowish red (5YR 4/8), brown (10YR 5/3), and gray (N 5/0); weak, thick, platy structure that parts to weak, very fine, subangular blocky; firm, slightly sticky, and slightly plastic; 12 percent coarse fragments as much as 5 inches in diameter; medium acid; abrupt, wavy boundary.

IIIC1—52 to 64 inches, reddish-brown (5YR 5/4) gravelly coarse sand; many, medium, distinct mottles of pinkish gray (7.5YR 7/2) and dark grayish brown (10YR 4/2); single grain; firm, nonsticky, nonplastic; 35 percent coarse fragments as much as 6 inches in diameter; medium acid; abrupt, wavy boundary.

IIIC2—64 to 70 inches, brown (7.5YR 5/4) gravelly fine sandy loam; many, coarse, prominent mottles of gray (N 6/0) and red (2.5YR 4/8); weak, medium, subangular blocky structure; firm,

nonsticky, nonplastic; 20 percent coarse fragments as much as 6 inches in diameter; neutral.

The solum ranges from 40 to 60 inches in thickness. Depth to hard bedrock ranges from more than 6 feet to more than 50 feet. Depth to mottling is 18 to 36 inches.

The A1 horizon ranges from very dark gray to dark yellowish brown. The B1 and B21t horizons range from brown to yellowish brown in color and from loam to silty clay loam in texture. The IIIC1 and IIIC2 horizons range from brown or reddish brown to gray in color and from very fine sandy loam to coarse sand or gravelly analogues in texture.

Phelps soils, thick solum variant, the well-drained Conotton soils, the somewhat poorly drained Red Hook soils, and the very poorly drained Halsey soils formed in similar material. Phelps soils, thick solum variant, are similar to the Comly, Buchanan, Clarksburg, Urbana, Wurtsboro, and Middlebury soils in drainage. Phelps soils, thick solum variant, lack a fragipan that is characteristic of the Comly, Buchanan, Clarksburg, Urbana, and Wurtsboro soils. Middlebury soils lack a Bt horizon.

Phelps gravelly silt loam, thick solum variant, 2 to 8 percent slopes (PhB).—This is the only Phelps soil mapped in the county. Areas are long and narrow and range from 2 to 15 acres in size.

Included with this soil in mapping were small areas of cobbly or stony soils, areas of soils that have a silt loam or loam surface layer, areas of soils that have a thick fragipan, and areas of soils where the combined thickness of the surface layer and subsoil is less than 3 1/2 feet.

If this soil is protected from erosion, it is suited to most crops commonly grown in the county. The erosion hazard is moderate, but a few small rills are in areas where the surface is unprotected. Moderately slow permeability and seasonal high water table are the major limitations to most nonfarm uses. Capability unit IIe-1.

Red Hook Series

The Red Hook series consists of deep, somewhat poorly drained, nearly level soils. These soils are on gravelly outwash terraces, on valley fill, on kames, and on low terraces along streams. They formed in stratified glacial drift composed of many different kinds of material.

In a representative profile the surface layer is black gravelly silt loam 5 inches thick. The subsurface layer is brown sandy loam 5 inches thick and has mottles of brown and light brownish gray. The subsoil, between depths of 10 and 35 inches, consists of grayish-brown very fine sandy loam that has yellowish-brown and light brownish-gray mottles over grayish-brown loam that has gray and strong-brown mottles. The substratum, below a depth of 35 inches consists of a layer of gray gravelly loamy sand over a layer of gray clay loam. The substratum has mottles of grayish brown, yellowish brown, strong brown, and brown.

Permeability is moderately slow, and available moisture capacity is moderate. The water table is between depths of 6 and 18 inches during wet periods. Depressions are subject to ponding during heavy rains.

Most areas of this soil are in permanent pasture or are wooded. Some cleared areas are farmed in the same manner as closely associated better drained soils. Idle areas are reverting to woodland. Quarries, canals, and other nonfarm areas make up a small percentage of the acreage.

If these soils are drained, they are suited to most crops commonly grown in the county, except alfalfa, potatoes, and winter grain. Moderately slow permeability and a seasonal high water table are limitations to most nonfarm uses.

Representative profile of Red Hook gravelly silt loam, in cutover woodland along the northern edge of the lake at East Bangor in Upper Mount Bethel Township.

A1—0 to 5 inches, black (10YR 2/1) gravelly silt loam; moderate, very fine, subangular blocky structure; friable, nonsticky, nonplastic; 15 percent coarse fragments; slightly acid; abrupt, wavy boundary.

A2—5 to 10 inches, brown (10YR 5/3) sandy loam; many, fine, faint mottles of brown (10YR 4/3) and light brownish gray (10YR 6/2); weak, thin, platy structure; friable, nonsticky, nonplastic; black (10YR 2/1) material from A1 horizon deposited in worm holes and root channels; 2 percent coarse fragments; medium acid; clear, wavy boundary.

B1—10 to 21 inches, grayish-brown (10YR 5/2) very fine sandy loam; many, medium, faint mottles of yellowish brown (10YR 5/8) and light brownish gray (10YR 6/2); weak, medium, subangular blocky structure; friable, slightly sticky, slightly plastic; few thin clay films in pores, 10 percent coarse fragments; medium acid; clear, wavy boundary.

B2—21 to 35 inches, grayish-brown (10YR 5/2) loam; many, coarse, prominent mottles of gray (N 6/0) and strong brown (7.5Y 5/8); moderate, medium and coarse, blocky structure; firm, slightly sticky, slightly plastic; many thin clay films in pores, 10 percent coarse fragments; slightly acid; clear, wavy boundary.

IIC1g—35 to 42 inches, gray (10YR 5/1) gravelly loamy sand; many, fine, faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/4); weak, medium, platy structure; firm, nonsticky, nonplastic; 18 percent coarse fragments; slightly acid; abrupt, wavy boundary.

IIIC2g—42 to 62 inches, gray (N 5/0) clay loam; many, coarse, distinct mottles of strong brown (7.5YR 5/6) and brown (10YR 5/3); weak, thick, platy structure parting to weak, very fine, blocky; firm, slightly sticky, slightly plastic; 12 percent coarse fragments; neutral.

The solum ranges from 22 to 35 inches in thickness. Depth to hard bedrock ranges from 6 feet to more than 50 feet.

The A1 horizon ranges from black to dark grayish brown. The B1 and B2 horizons range from grayish brown to light brownish gray in color and from very fine sandy loam to silt loam in texture. Texture of the IIC1g and IIIC2g horizons ranges from clay loam to coarse sand or gravelly or cobbly analogs.

The Red Hook soils in Northampton County have a somewhat higher pH value than is defined for the series, but this difference does not alter their use, management, or behavior.

Red Hook soils, the well-drained Conotton soils, the moderately well drained Phelps, thick solum variant, soils, and the very poorly drained Halsey soils formed in similar material. Red Hook soils are similar to Comly, Buchanan, and Volusia soils in drainage, but they lack the fragipan typical of those soils.

Red Hook gravelly silt loam (0 to 5 percent slopes) (Rh).—This is the only Red Hook soil mapped in the county. The areas are long and narrow and range from 2 to 40 acres in size.

Included with this soil in mapping were areas of cobbly or stony soils, areas of soils that have a distinct fragipan, and areas in which the thickness of the surface layer and subsoil combined is more than 35 inches. Also included were areas of soils that have a gravelly loam surface layer.

If these Red Hook soils are drained, they are suited to most crops commonly grown in the county except alfalfa, potatoes, and winter grain. Restricted permeability and a seasonal high water table are limitations to most nonfarm uses. Capability unit IIIw-1.

Rubble Land

Rubble land (Ru) consists of areas that are more than 90 percent covered with stones and boulders (fig. 21). Significant soil features are obscured by the stone cover. The geologic material is commonly gray massive sandstone and conglomerate, but it also includes quartzite. Weathering has partly rounded most of the stones and boulders. Rubble land is on mountainsides and ridges. The areas are irregular

Figure 21.—An area of Rubble land on Blue Mountain; the surface is a pavement of boulders and stone.

in shape and range from about 2 to 100 acres in size. Slopes range from 8 to 75 percent.

Included with this land type in mapping were a few nearly level to gently sloping soils and some areas of rock outcrop, mostly in the form of escarpments. Also included were small areas of Stony land.

Because Rubble land is coarse textured, it generally supports little or no vegetation, but some areas have thin scrubby stands of chestnut oak and red maple. Rubble land has no value for farming and is best suited to watersheds or esthetic uses. Capability unit VIIIs-1.

Ryder Series

The Ryder series consists of moderately deep, well-drained, gently sloping to sloping soils on uplands. These soils formed in material weathered from interbedded limestone and shale, which have been influenced by glaciation.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is yellowish-brown silt loam 20 inches thick. The substratum, at a depth of about 28 inches, is a dark yellowish-brown channery silt loam that is 40 percent coarse fragments. Depth to shaly limestone is 32 inches.

Ryder soils have moderate available moisture capacity and moderate permeability.

Most areas of these soils are farmed. Some areas are used for pasture and others are idle or wooded.

The major limitation of these soils is the moderate depth to bedrock.

Representative profile of Ryder silt loam, 8 to 15 percent slopes, in a cultivated field, adjacent to the Lehigh School in Lower Mount Bethel Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable, nonsticky, nonplastic; 12 percent coarse fragments; moderately alkaline; abrupt, smooth boundary.

B1—8 to 17 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, granular structure; friable, slightly sticky, nonplastic; thin patchy clay films in pores and root channels; 5 percent coarse fragments; neutral; gradual, wavy boundary.

B2t—17 to 28 inches, yellowish-brown (10YR 5/8) heavy silt loam to silty clay loam; moderate, medium and coarse, subangular blocky structure; firm, sticky, slightly plastic; thin patchy clay films on peds; 2 percent coarse fragments; neutral; gradual, wavy boundary.

C—28 to 32 inches, dark yellowish-brown (10YR 4/4) channery silt loam; weak, medium, granular structure partly obscured by coarse fragments; friable, slightly sticky, slightly plastic; 40 percent coarse fragments; neutral; abrupt, smooth boundary.

R—32 inches, dark grayish-brown (2.5Y 4/2) shaly limestone.

The solum ranges from 21 to 30 inches in thickness. Depth to bedrock is 24 to 40 inches. From 2 to 15 percent channery limestone fragments occur throughout the solum.

The Ap horizon ranges from dark yellowish brown to dark grayish brown. The B1 and B2t horizons range from yellowish brown to light olive brown in color and from silt loam to silty clay loam in texture. The C horizon contains from 40 to 80 percent channery fragments and flagstone. Where the soil overlies relatively pure limestone, the C horizon consists of a very thin layer of weathered parent material, but where interbedded shale and limestone bedrock are present, this layer as much as 18 inches thick.

Ryder soils, the deep, well-drained Duffield soils, the moderately well drained Clarksburg soils, and the moderately well drained to somewhat poorly drained Comly soils formed in similar material. Ryder soils are similar to the Berks and Hollinger soils in thickness of the solum. They have less coarse fragments throughout the solum than Berks soils. They are not so deep to bedrock as Hollinger soils.

Ryder silt loam, 2 to 8 percent slopes (RyB.)—This soil is on smooth to convex uplands and on toe slopes of shale ridges. It generally has a southern exposure. The areas are irregular in shape and range from 3 to more than 30 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer and subsoil combined are thicker; depth to bedrock is greater; and fewer coarser fragments are in the upper horizons.

Included with this soil in mapping were some areas where slopes are less than 2 percent. Also included were areas in depressions where soil material, about 12 inches thick, has been deposited on the surface. These areas are seasonally wet.

This Ryder soil is suited to all crops commonly grown in the county. Moderate depth to bedrock is the major limitation to many nonfarm uses. Capability unit IIe-3.

Ryder silt loam, 8 to 15 percent slopes (RyC).—This soil is on convex uplands and on the lower toe slopes of shale ridges. It generally has a southern exposure. The areas are irregular in shape and range from 3 to more than 30 acres in size. This soil has the profile described as representative for the series. The hazard of erosion is moderate to high in cultivated areas.

Included with this soil in mapping were small areas of Duffield silt loam, 8 to 15 percent slopes.

If this Ryder soil is protected from erosion, it is suited to all crops commonly grown in the county. Steepness of slope and moderate depth to bedrock are major limitations to most nonfarm uses. Capability unit IIIe-3.

Stony Land

Stony land (St) consists of areas that are 50 to 90 percent covered with stones and boulders (fig. 22). Significant soil features are obscured by the stone cover. The geologic material is commonly gray massive sandstone and conglomerate, but it also includes quartzite. Weathering has partly rounded most of the stones and boulders. Stony land is on mountains, hills, and ridges. Areas are irregular in shape and range from about 2 to more than 100 acres in size.

Included with this land type in mapping were areas of rock outcrop, mostly in the form of escarpments, and areas of Rubble land where more than 90 percent of the surface is covered with stones and boulders. Also included were a few small areas that have limestone material; small areas of bouldery glacial material; and areas that have impeded drainage. Stony land generally supports a thin, scrubby stand of oak and red maple, but some areas have a fairly good stand of merchantable timber. Steep slopes make harvesting of timber impossible in most areas, and replanting trees is impractical. Stony land has little value for farming and is best suited to watersheds or esthetic uses. Capability unit VIIIs-1.

Swartswood Series

The Swartswood series consists of deep, well-drained, gently sloping to moderately steep soils on hills, ridges, and benches. Slopes are generally convex. These soils formed in compact glacial till composed of material weathered from gray shale, quartzite, siltstone, sandstone, and a small amount of limestone. This till is primarily deposited over shale and slate uplands.

In a representative profile a mat of partly decomposed leaf litter overlies a surface layer of dark-brown gravelly loam about 2 inches thick. The upper part of the subsoil, between a depth of 2 and 20 inches, is light yellowish-brown and brownish-yellow, friable gravelly loam. Below a depth of 20 inches is a firm fragipan of brown and yellowish-brown gravelly sandy loam to very gravelly sandy loam. It has light-gray and strong-brown mottles below a depth of 42 inches and extends to a depth of more than 88 inches.

Swartswood soils have low available moisture capacity and moderate permeability. The water table is within a depth of 30 inches during rainy periods. Most areas of these areas are farmed, but many areas are extremely stony and are wooded. The rest of the areas are idle or are used for residential and recreational sites. Low available moisture capacity, high gravel content, and steepness of slope are the major limitations to use of these soils.

Representative profile of Swartzwood gravelly loam in an area of Swartswood and Wurtsboro extremely stony soils, 0 to 8 percent slopes, in second-growth woodland, three-fourths mile northwest of Portland in Upper Mount Bethel Township. (This is profile S67 PA-48-32 (1-10) for which physical and chemical data are given in tables 11 and 12):

02—1 inch to 0, black (10YR 2/1) partly decomposed leaf litter; very strongly acid; abrupt, smooth boundary.

A1—0 to 2 inches, dark-brown (10YR 3/3) gravelly loam; weak, fine, granular structure; very friable, nonsticky, nonplastic; 20 percent gravel; medium acid; abrupt, smooth boundary.

B1—2 to 9 inches, brownish-yellow (10YR 6/6) gravelly loam; weak, fine, subangular blocky structure; friable, slightly sticky, slightly plastic; some clay bridging; few thin clay films in pores; 20 percent gravel, few cobblestones; medium acid, clear, wavy boundary.

B2—9 to 20 inches, light yellowish-brown (10YR 6/4) to brownish-yellow (10YR 6/6) gravelly loam; moderate, fine and medium, subangular blocky structure; friable, sticky, slightly plastic; few thin clay films in pores with some bridging; 30 percent gravel and cobblestones; medium acid; wavy boundary.

Bx1—20 to 26 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; weak, coarse, prismatic structure that parts to weak, medium, platy; firm, brittle, slightly sticky, slightly plastic; a few pores have thick clay films; 35 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx2—26 to 42 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; weak, coarse, prismatic structure with weak, medium, platy, or massive interiors; very firm, brittle, slightly sticky, slightly plastic; few, thick, brown (7.5YR 5/4) clay film patches on ped faces and in pores; 35 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

Figure 22.—An area of Stony land covered with a fairly good stand of second growth timber.

Bx3—42 to 52 inches, brown (7.5YR 5/4) very gravelly sandy loam; few, medium, distinct, yellowish-brown (10YR 5/4) and strong-brown (7.5YR 5/6) mottles; moderate, very coarse, prismatic structure with weak, medium, platy, or massive interiors; very firm, brittle, slightly sticky, slightly plastic; few, thick, clay film patches on ped faces and in pores; 50 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx4—52 to 64 inches, yellowish-brown (10YR 5/4) very gravelly sandy loam; few, medium, distinct, light-gray (10YR 7/2) and strong-brown (7.5YR 5/6) mottles, light-brown (7.5YR 6/4) and light yellowish-brown (10YR 6/4) prism faces; moderate, very coarse, prismatic structure with weak, medium, platy, or massive interiors; very firm, brittle, slightly sticky, slightly plastic; few, thick, clay film patches on ped faces and in pores; few black manganese coatings; 60 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx5—64 to 75 inches, yellowish-brown (10YR 5/4) very gravelly sandy loam; few, medium, distinct, light-gray (10YR 7/2) and strong-brown (7.5YR 5/6) mottles; moderate, very coarse, prismatic structure with weak, medium, platy, or massive interiors; very firm, brittle, slightly sticky, slightly plastic; few, thick, clay film patches on ped faces and in pores; 75 percent gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx6—75 to 88 inches, yellowish-brown (10YR 5/4) very gravelly sandy loam; few, medium, distinct, light-gray (10YR 7/2) and strong-brown (7.5YR 5/6) mottles; moderate, very coarse, prismatic structure with weak, medium, platy or massive interiors; firm, brittle, slightly sticky, slightly plastic; few thin clay films in pores; 85 percent gravel and cobblestones; slightly acid.

The solum ranges from 72 to 90 inches in thickness. Depth to hard bedrock ranges from more than 6 feet to more than 20 feet. Depth to the fragipan ranges from 18 to 30 inches. Stones on the surface and throughout the profile range from 0 to 30 percent. Coarse fragments smaller than stones constitute 15 to 35 percent of the soil mass at a depth of less than 42 inches and 35 to 75 percent below a depth of 42 inches (fig. 23).

The Ap horizon in plowed areas ranges from grayish brown to brown. The B horizon ranges from brownish yellow to dark brown.

Swartswood soils in Northampton County have a somewhat thicker solum than is defined for the series, but this difference does not alter their use, management, or behavior.

Swartswood soils, the moderately well drained Wurtsboro soils, the somewhat poorly drained Volusia soils, and the poorly drained Chippewa soils formed in similar material. Swartswood soils are similar to the Bedington, Laidig, Washington, Duffield, Conestoga, Conotton, and Berks soils in drainage. They lack the Bt horizon that is typical of the Bedington, Laidig, Washington, Duffield, Conestoga, and Conotton soils. They have a thicker solum than Berks soils.

Figure 23.—Representative profile of a Swartswood gravelly loam near Factoryville. Note the great range in size of coarse fragments.

Swartswood gravelly loam, 2 to 8 percent slopes (SvB).—This soil is on broad undulating hills and ridgetops and on convex hillsides. The areas are oval, oblong, or irregular in shape, and they range from 2 to more than 20 acres in size. The hazard of erosion is moderate.

Included with this soil in mapping were uneroded wooded areas. Also included were areas of soils that have mottles at a depth of between 24 and 42 inches and some areas of soils that have a weak fragipan.

Most of this Swartswood soil is in crops. This soil is suited to most crops commonly grown in the county. The high gravel content is a limitation to most other uses. Capability unit IIs-1.

Swartswood gravelly loam, 8 to 15 percent slopes (SvC).—This soil is on hillsides and ridgetops. The areas are irregular in shape and range from 2 to more than 15 acres in size. If this soil is cleared, the hazard of erosion is high.

Included with this soil in mapping were a few uneroded wooded areas, some areas of soils that have weak fragipan development, and areas of soils that have mottles at a depth of 26 inches.

Most of this Swartswood soil is in crops. If this soil is protected from erosion, it is suited to most crops commonly grown in the county. Steepness of slope and a high gravel content are limitations to many uses. Capability unit IIIe-2.

Swartswood gravelly loam, 15 to 25 percent slopes (SvD).—This soil is on hillsides in irregularly shaped areas that range about 2 to 12 acres in size. The profile of this soil is similar to the one described as representative for the series, but it is thinner. If this soil is cleared, the hazard of erosion is high.

Included with this soil in mapping were some areas that have a weak fragipan and areas that have mottles below a depth of 30 inches.

Most of this Swartswood soil is in crops and pasture, but some areas are wooded. Because of steepness of slope, this soil is poorly suited to crops, but it is suited to pasture and woodland. Steepness of slope and a high gravel content are limitations to most uses. Capability unit IVe-2.

Swartswood and Wurtsboro extremely stony soils, 0 to 8 percent slopes (SwB).—These soils are on undulating to smooth uplands that have many potholes and depressions. The areas generally are oval or irregular in shape and range from 5 to more than 50 acres in size. Stones as much as 5 feet in diameter cover 10 to 30 percent of the surface. Mapped areas consist of Swartswood soils, Wurtsboro soil, or both. About 60 percent of the acreage is Swartswood extremely stony loam, and about 40 percent is Wurtsboro extremely stony silt loam. The Swartswood soil has a profile similar to the one described as representative for the Swartswood series. The profile of the Wurtsboro soil is similar to the one described as representative for the Wurtsboro series, except that it has so many stones and boulders on the surface, in the surface layer, and in the subsoil that cultivation is not practical.

Included with these soils in mapping were some areas near Laurel Hill where the soils are only 2 to 6 feet deep over bedrock.

Most areas of these soils are wooded. Because of the stony surface, these soils are better suited to unimproved pasture, tree plantings, or wildlife habitat than to other uses. Stoniness is the major limitation to most nonfarm uses. Capability unit VIIs-3.

Swartswood and Wurtsboro extremely stony soils, 8 to 25 percent slopes (SwD).—These soils are on rolling to smooth uplands that have many potholes and depressions. The areas generally are oval or irregular in shape and range from 5 to more than 75 acres in size. Stones as much as 5 feet in diameter cover 10 to 30 percent of the surface. Mapped areas consists of Swartswood soils, Wurtsboro soils, or both. About 75 percent of this unit is Swartswood extremely stony loam and about 25 percent is Wurtsboro extremely stony silt loam.

The profile of the Swartswood soil is similar to the one described as representative for the Swartswood series. The profile of the Wurtsboro soils is similar to the one described as representative for the Wurtsboro series, except that many stones and boulders are on the surface, in the surface layer, and in the subsoil that cultivation is not practical.

Included with these soils in mapping were small areas where slopes are more than 25 percent. Also included were areas near Laurel Hill where the soils are only 2 to 6 feet deep over bedrock.

Most areas of these soils are wooded. Because of the stony surface, these soils are better suited to unimproved pasture, tree plantings, or wildlife habitat than to other

uses. Stoniness and steepness of slope are the major limitations to most nonfarm uses. Capability unit VIIs-3.

Urban Land

Urban land occurs in industrial and residential areas of the county. Most areas are on uplands, but some are on terraces and flood plains. Urban structures and works obscure the land, and identification of the soils is not practical. In many places the activities of man have completely destroyed the original soil profile, but in many scattered areas the soils remain intact. Urban land is used as sites for homes, shopping centers, schools, factories, roads, cemeteries, golf courses, railroads, and other urban and industrial facilities. The largest areas are in Bethlehem and Easton and in the rapidly developing townships between them (fig. 24).

Most areas of Urban land are suitable only as sites for urban and industrial developments. Onsite investigation of individual areas is needed to determine the hazards and the limitations to most uses.

Urban land, nearly level (UrA) is on hilltops and uplands that have low relief. Slopes are smooth or slightly convex. The surface of most areas is stabilized artificially or by vegetation. The hazard of erosion is high if the surface cover is inadequate. The color and the texture of the soil material vary. The areas range from about 2 to more than 400 acres in size and are irregular in shape. Included in mapping were small areas of waste material from iron ore mines and steel industries and a few areas that have been cut and filled with soil and trashy material.

Some small areas of this mapping unit south of the Lehigh River have been leveled and are farmed. Not placed in a capability unit.

Urban land, sloping (UrC) is on hillsides and ridges on uplands. Slopes are smooth or slightly convex. The surface of most areas is stabilized artificially or by vegetation. The hazard of erosion is high if the surface cover is inadequate. The color and the texture of the soil material vary. The areas range from about 2 to more than 100 acres in size and are irregular in shape.

Figure 24.—Buffer of trees between Urban land and the undeveloped countryside.

Included with this unit in mapping were some areas where slopes are steeper than 25 percent and a few earth and rock escarpments. Also included were areas of waste material from iron ore mines and steel industries and a few areas that have been cut and filled with soil and trashy material. Not placed in a capability unit.

Urban land, occasionally flooded (Us) is on smooth or slightly concave flood plains. The soil material varies in color and in texture, but all of it consists of water-laid sediment. Before selecting an area for a specific use, onsite investigation is needed to determine the flooding frequency of the area. Most of the areas are long and narrow and parallel the nearby streams. The areas range from about 5 to 50 acres in size.

Included with this unit in mapping were a few cut and fill areas where slopes are more than 8 percent and some areas of industrial waste material. Not placed in a capability unit.

Urbana Series

The Urbana series consists of deep, moderately well drained, gently sloping to sloping soils that formed in material weathered from granite, schist, quartzite, and gneiss. These soils are on lower toe slopes of ridges, around stream heads, and in drainageways, where seepage causes the water table to rise during wet periods.

In a representative profile the surface layer is dark-brown silt loam about 9 inches thick. The upper part of the subsoil, at a depth between 9 and 19 inches, is slightly firm, dark yellowish-brown silt loam. The lower part of the subsoil, at a depth between 19 and 38 inches, is firm and very firm fragipan. The fragipan is yellowish-brown loam over yellowish-red gravelly loam that has some mica flakes. The substratum is strong-brown sandy loam and extends to a depth of 50 inches.

Urbana soils have moderate available moisture capacity. Permeability of the subsoil is moderately slow, and the water table rises to within 1 1/2 to 3 feet of the surface during wet periods. In places, ponding occurs during periods of heavy rainfall. Most areas of Urbana soils are used for crops and pasture. Some of the wetter areas are idle.

If these soils are protected from erosion, they are suited to most crops commonly grown in the county, but alfalfa and winter grain are affected by winterkill. The seasonal high water table and moderately slow permeability are the major limitations to most nonfarm uses.

Representative profile of Urbana silt loam, 2 to 10 percent slopes, in a cultivated field at the eastern intersection of State Legislative Route 48009 and Township RouteT406 in Lower Saucon Township:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable, nonsticky, nonplastic; 8 percent coarse fragments; neutral; abrupt, wavy boundary.

B2t—9 to 19 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium to coarse, subangular blocky structure; slightly firm, nonsticky, nonplastic; few, thin, discontinuous clay films in pores; 5 percent coarse fragments; slightly acid; clear, wavy boundary.

Bx1—19 to 24 inches, yellowish-brown (10YR 5/4) loam; many, fine, distinct to faint, brown (7.5YR 5/4) and yellowish-brown (10YR 5/8) mottles; weak, thick, platy structure breaking to weak, very fine, subangular blocky; firm, brittle, slightly sticky and slightly plastic; few, thick, discontinuous clay films on ped surfaces and lining pores; 10 percent gravel; slightly acid; clear, wavy boundary.

Bx2—24 to 38 inches, yellowish-red (5YR 4/8) gravelly loam; many, coarse, faint to prominent, yellowish-red (5YR 5/8), strong-brown (7.5YR 5/8), grayish-brown (10YR 5/2), and light brownish-gray (10YR 6/2) mottles; weak, thick, platy structure that parts to weak, very fine, subangular blocky; very firm, brittle, slightly sticky, nonplastic; few, thick, discontinuous clay films on ped surfaces; 20 percent coarse fragments; some mica flakes; slightly acid; clear, wavy boundary.

C—38 to 50 inches, strong-brown (7.5YR 5/8) sandy loam; high content of mica flakes; many, coarse, prominent, slight yellowish-brown (10YR 6/4) and light brownish-gray (10YR 6/2) mottles; massive; firm, nonsticky, nonplastic; 12 percent gravel; moderately acid.

The solum ranges from 36 to 48 inches in thickness. Depth to hard bedrock is more than 4 feet.

The Ap horizon ranges from dark brown to dark grayish brown. The B2t and Bx1 horizons range from dark brown to brownish yellow. The Bx2 horizon is yellowish brown, yellowish red, strong brown, and dark grayish brown.

Urbana soils in Northampton County have low-chroma mottles, at a slightly greater depth, and they have fewer schistose coarse fragments than is defined for the series, but these differences do not alter their use, management, or behavior.

Urbana soils, the well-drained Conestoga and Hollinger soils, and the poorly drained Baile soils, neutral variant, formed in similar material. Urbana soils and the Phelps, Wurtsboro, Comly, and Buchanan soils are similar in drainage. Phelps soils have no fragipan; the Wurtsboro soils have no Bt horizon; and the Comly and Buchanan soils do not have mica flakes in the lower part of the solum.

Urbana silt loam, 2 to 10 percent slopes (UtB).—This is the only Urbana soil mapped in the county. It is on concave and smooth uplands that have a few depressions. The areas range from 2 to more than 20 acres in size. In cultivated areas there are some small rills and few channels.

Included with this soil in mapping were areas of the poorly drained Baile soils, neutral variant, and a small acreage of Urbana soils that have slopes of 10 percent. Also included were a few acres of moderately well drained to somewhat poorly drained, gently sloping, red soils. These red soils are in a small area at the extreme southern part of Lower Saucon Township.

If this Urbana soil is protected from erosion, it is suited to most crops commonly grown in the county. The erosion hazard is moderate. Moderately slow permeability and a seasonal high water table are major limitations to most nonfarm uses. Capability unit IIe-1.

Volusia Series

The Volusia series consists of deep, somewhat poorly drained, nearly level to gently sloping soils in swales, drainageways, and on undulating upland flats. These soils formed in compact glacial till composed of material weathered from gray shale, quartzite, siltstone, sandstone, and a small amount of limestone. The till is primarily deposited over uplands underlain by shale and slate.

In a representative profile the surface layer is dark grayish-brown gravelly silt loam about 9 inches thick. The upper part of the subsoil, between depths of 9 and 17 inches, is yellowish-brown friable gravelly loam that has light brownish-gray and strong-brown mottles. Below a depth of 17 inches is a yellowish-brown gravelly loam fragipan that has light brownish-gray coatings on the prism and ped faces. The fragipan has light brownish-gray and strong-brown mottles and extends to a depth below 81 inches.

Permeability is slow, and available moisture capacity is low. A water table is within a depth of 1/2 to 1 1/2 feet during wet periods. Depressions frequently are ponded. Some areas are extremely stony and are wooded. In other areas fields are cleared and the stones are piled in fence rows. The cleared areas are mainly used for hay and pasture or are idle. Few areas are used for crops. Slow permeability and a

seasonal high water table are limitations to use of these soils.

Representative profile of Volusia gravelly silt loam, 2 to 8 percent slopes, in an idle field, 2 miles south of East Bangor in Washington Township. (This profile S67Pa-48-26 (1-8) for which physical and chemical data are given in tables 11 and 12.):

Ap—0 to 9 inches, dark grayish-brown (2.5Y 4/2) gravelly silt loam; moderate, medium and coarse, granular structure; very friable, slightly sticky, slightly plastic; 15 percent gravel as much as 1 1/2 inches in diameter; slightly acid; abrupt, smooth boundary.

B2—9 to 17 inches, yellowish-brown (10YR 5/4) gravelly loam; many, medium, distinct, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/8) mottles; weak, coarse, subangular blocky structure; friable, slightly sticky, plastic; few thin clay films in pores; 15 percent gravel as much as 1 1/2 inches in diameter; medium acid; clear, wavy boundary.

Bx1g—17 to 27 inches, yellowish brown (10YR 5/4) gravelly loam; many, medium, distinct, strong-brown (7.5YR 5/8) and (7.5YR 5/6) and light brownish-gray (2.5Y 6/2) mottles, light brownish-gray (2.5Y 6/2) prism and ped coatings; moderate, very coarse, prismatic structure that parts to very thick, platy; firm, brittle, slightly sticky, plastic; few, thin clay films in pores; 25 percent gravel as much as 2 inches in diameter; medium acid; gradual, wavy boundary.

Bx2g—27 to 39 inches, yellowish-brown (10YR 5/4) gravelly loam; few, medium, distinct, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6) and (7.5YR 5/8) mottles, light brownish-gray (2.5Y 6/2) prism and ped coatings; moderate, very coarse, prismatic structure that parts to moderate, very thick, platy; firm, brittle, slightly sticky, plastic; many thin clay films in pores; 30 percent gravel, few cobblestones; medium acid; gradual, wavy boundary.

Bx3g—39 to 50 inches, yellowish-brown (10YR 5/4) gravelly loam; few, medium, distinct, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6) and (7.5YR 5/8) mottles, light brownish-gray (2.5Y 6/2) prism and ped coatings; moderate, very coarse, prismatic structure that parts to weak, very thick, platy; firm, brittle, slightly sticky, plastic; many thin clay films in pores; few black iron and managanese coatings; 35 percent fine gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx4g—50 to 57 inches, yellowish-brown (10YR 5/4) gravelly loam; few, medium, distinct, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6) and (7.5YR 5/8) mottles, light brownish-gray (2.5Y 6/2) prism and ped coatings, moderate, very coarse, prismatic structure that parts to weak, very thick, platy; firm, brittle, slightly sticky, plastic; many, moderately thick clay film patches in pores; few black iron and manganese coatings; 35 percent fine gravel and cobblestones; medium acid; gradual, wavy boundary.

Bx5g—57 to 67 inches, yellowish-brown (10YR 5/4) gravelly loam; common, medium, distinct, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6) and (7.5YR 5/8) mottles, light brownish-gray (2.5Y 6/2) prism and ped coatings; moderate, very coarse, prismatic structure that parts to weak, medium and thick, platy; plates are coated with light olive gray (5Y 6/2); firm, brittle, slightly sticky, plastic; few black iron and manganese coatings; 40 percent fine gravel, few cobblestones; common shale fragments; medium acid; gradual, wavy boundary.

Bx6g—67 to 81 inches, yellowish-brown (10YR 5/4) very gravelly loam; few, medium, distinct, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6) and (7.5YR 5/8) mottles, light brownish-gray (2.5Y 6/2) prism and ped coatings; moderate, very coarse, prismatic that parts to weak, medium and thick, platy; firm, brittle, slightly sticky, plastic; common, thin to moderately thick clay films in pores, few black iron and manganese coatings; 45 percent fine gravel, and 20 percent shale fragments; medium acid.

Depth to hard bedrock ranges from more than 6 feet to more than 20 feet. The solum is more than 66 inches thick. Depth to fragipan ranges from 12 to 18 inches.

The Ap and B2 horizons range from 15 to 30 percent in content of coarse fragments, but the content increases from 30 to 70 percent in the lower part of the profile. The B2 horizon ranges from silt loam to gravelly loam. The Bx horizon ranges from light brownish gray to grayish brown. The Bx horizon ranges from loam to silt loam or gravelly and shaly analogs.

Volusia soils in Northampton County have a somewhat thicker solum than is defined for the series, but this difference does not alter their use, management, or behavior.

Volusia soils, the well drained Swartswood soils, the moderately well drained Wurtsboro soils, and the poorly drained Chippewa soils formed in similar material. Volusia soils have drainage characteristics similar to those of the Comly, Buchanan, and Red Hook soils. Volusia soils have a Bt horizon that is absent in the Comly and Buchanan soils. They have a fragipan that Red Hook soils lack.

Volusia gravelly silt loam, 2 to 8 percent slopes (VoB).—This soil is on broad toe slopes and in drainageways and depressions. The areas are generally long and narrow and range from 2 to more than 25 acres in size. The soil has the profile described as representative for the series. Drainage channels or gullies are common where slopes are more than 5 percent.

Included with this soil in mapping were small isolated areas of Chippewa soils and areas of Volusia soils that have a flaggy and cobbly surface layer.

If this soil is artificially drained, it is suited to most crops commonly grown in the county. Slow permeability, a seasonal high water table, and a high gravel content are the major limitations to most nonfarm uses. Capability unit IIIw-1.

Volusia extremely stony silt loam, 0 to 8 percent slopes (VuB).—This soil is in smooth or slightly concave upland areas that have numerous potholes or depressions. It is primarily along drainageways or in swales. The areas are generally long and narrow and range from 5 to more than 50 acres in size. Stones 1 to 3 feet in diameter cover 5 to 25 percent of the surface.

Nearly all of this soil is wooded. This soil is too stony and too wet for cultivated crops or pasture. Removing the stones is feasible in some areas. Most of the acreage is better suited to trees than to pasture. Stoniness, slow permeability, and a seasonal high water table are the major limitations to most nonfarm uses. Capability unit VIIs-1.

Washington Series

The Washington series consists of deep, well-drained, nearly level to very steep soils on smooth to mildly karst uplands. These soils formed in glacial till and frost-churned material weathered mostly from limestone.

In a representative profile the surface layer is dark yellowish-brown silt loam 10 inches thick. The upper part of the subsoil is strong-brown, friable silty clay loam about 20 inches thick. The lower part of the subsoil is firm, yellowish-red clay loam about 42 inches thick. The substratum below a depth of 72 inches is dark-brown loam that has 8 percent coarse fragments.

Washington soils have high available moisture capacity and moderate permeability. Closed depressions, potholes, and sinks limit the movement of eroded soil material to short distances.

Most areas of these soils are cultivated. A few small woodlots remain on farms and in areas that are steep or rocky. Where steepness of slope is not a limitation, Washington soils are well suited to all crops commonly grown in the county.

Representative profile of Washington silt loam, 3 to 8 percent slopes, in a cultivated field at the Edward C. Tracy Elementary School, along State Legislative Route 48017 in Palmer Township:

Ap—0 to 10 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium and coarse, granular structure; friable, slightly

sticky, nonplastic; 7 percent quartz and sandstone pebbles; neutral; abrupt, smooth boundary.

B21t—10 to 30 inches, strong-brown (7.5YR 5/8) silty clay loam; moderate, medium and coarse, subangular blocky structure; friable, sticky, plastic; thin, continuous clay films in pores and on ped faces; common, black manganese coatings; 2 percent pebbles; neutral; abrupt, wavy boundary.

B22t—30 to 72 inches, yellowish-red (5YR 4/8) clay loam; moderate, thick, platy structure parting to weak, very fine, subangular blocky; firm, sticky, plastic; thick, continuous clay films on ped faces and in pores; common, black, manganese coatings; 3 percent channery limestone fragments; neutral; clear wavy boundary.

C—72 to 96 inches, dark brown (7.5YR 4/4) loam; massive; friable, slightly sticky, slightly plastic; thin patchy clay films on coarse fragments; 8 percent channery limestone fragments; mildly alkaline.

The solum ranges from 42 to 78 inches in thickness. Depth to hard bedrock is generally more than 6 feet, but it ranges from 5 to 20 feet. The content of coarse fragments ranges from 2 to 15 percent throughout the solum.

The Ap horizon ranges from dark yellowish brown to dark brown. The B21t and B22t horizons range from strong brown to yellowish brown in color and have a silty clay loam, clay loam, or sandy clay loam texture. The C horizon is dark-brown to yellowish-brown loam or sandy loam.

Washington soils, and the moderately well drained Clarksburg soils formed in similar material. Washington soils and the Duffield, Bedington, and Conestoga soils have similar characteristics, but Duffield soils have a higher content of silt than Washington soils, and Bedington soils have a higher content of shale throughout the solum. Washington soils have more clay in the B2 horizon than Conestoga soils, and they have limestone fragments in the lower part of the solum that is lacking in these soils.

Washington silt loam, 0 to 3 percent slopes (WaA).—This soil is in areas that commonly have sinkholes or closed depressions. The areas are irregular in shape and range from 5 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, except that the surface layer is thicker.

Included with this soil in mapping were areas where material from the subsoil is mixed with the material in the plow layer.

This Washington soil is well suited to all crops commonly grown in the county. It has few limitations to nonfarm uses. Capability unit I-1.

Washington silt loam, 3 to 8 percent slopes (WaB).—This soil is on broad undulating uplands. Sinkholes and closed depressions are not so numerous as in the more level areas of Washington silt loam. The areas range from 20 to more than 200 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were areas where material from the subsoil is mixed with that in the plow layer.

This Washington soil is suited to all crops commonly grown in the county. The hazard of erosion is moderate. There are few limitations to most nonfarm uses. Capability unit IIe-2.

Washington silt loam, 8 to 15 percent slopes (WaC).—This soil is on rolling, convex uplands that have a few closed depressions and rock outcrops. The areas are generally irregular in shape, but some are long and narrow. They range from 3 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but depth to bedrock is less, and the surface layer and the subsoil are thinner.

If this soil is cultivated, the hazard of erosion is severe. If this soil is protected from erosion, it is suited to all crops commonly grown in the county. Steepness of slope is the major limitation to most nonfarm uses. Capability unit IIIe-1.

Washington silt loam, 8 to 15 percent slopes, eroded (WaC3).—This soil is on rolling, convex uplands. Rills and small gullies are common. The areas generally are long and narrow and range from 2 to 25 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer and the subsoil are thinner, the content of coarse fragments is greater, and depth to bedrock is less. Also, in many areas material from the subsoil is mixed with the material in the plow layer, and in some places the subsoil is exposed.

Included with this soil in mapping were areas of rock outcrop, moderately eroded areas, and small areas where slopes are more than 15 percent.

This Washington soil is better suited to hay and pasture than to cultivated crops. Steepness of slope, susceptibility to further erosion, and rock outcrops are the major limitations to most nonfarm uses. Capability unit IVe-1.

Washington silt loam, 15 to 25 percent slopes (WaD).—This soil is on smooth and convex uplands along many of the major drainageways. Areas are generally long and narrow and range from 5 to 40 acres in size. The profile of this soil is similar to the one described as representative for the series, but depth to bedrock is somewhat less and the subsoil contains more rounded gravel and fragments of rock. The erosion hazard is very high. Rills are common, and there are a few gullies.

Included with this soil in mapping were some small escarpment-like areas and areas of rock outcrops.

This Washington soil is poorly suited to cultivated crops, but it is well suited to long-term hayland and pasture. The escarpment like areas are well suited to trees and to wildlife habitat. Steepness of slope is the major limitation to most nonfarm uses. Capability unit IVe-1.

Washington very rocky silt loam, 25 to 75 percent slopes (WhF).—This soil is on smooth, abrupt hillsides and escarpments along many of the larger drainageways. Areas are long and narrow and range from 5 to more than 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but it is considerably thinner, and rock outcrops and ledges make up about 15 percent of the mass.

Included with this soil in mapping were areas of sheer cliffs and about 50 acres of a very steep rocky Ryder soil.

Steepness of slope and rock outcrops are the major limitations to most uses. Capability unit VIIs-2.

Weikert Series

The Weikert series consists of shallow, well-drained soils on uplands. These soils formed in material weathered from glacial till and frost-worked, acid, gray shale. They are gently sloping to very steep soils and are on ridges and in the valleys in the northern part of the county.

In a representative profile the surface layer is brown channery silt loam about 8 inches thick. The subsoil is friable, very shaly silt loam about 8 inches thick that is 60 percent shale fragments. At a depth of 16 inches is fractured or frost-churned bedrock.

Weikert soils have low available moisture capacity and are droughty. Permeability is moderately rapid.

The high content of coarse fragments and shallowness to bedrock are major limitations to most nonfarm uses.

Representative profile of Weikert channery silt loam, 8 to 15 percent slopes, in a cultivated field, 1.9 miles southwest of Ackermanville in Plainfield Township.

'Ap—0 to 8 inches, brown (10YR 4/3) channery silt loam; moderate, fine, granular structure; very friable, nonsticky, nonplastic; many fine roots; 28 percent shale fragments; slightly acid; abrupt, wavy boundary.

B2—8 to 16 inches, yellowish-brown (10YR 5/4) very shaly silt loam; weak, fine, granular structure, largely obscured by coarse shale fragments; friable, nonsticky, nonplastic; few, thin, clay patches in pores and on shale chips, 60 percent shale fragments; neutral; diffuse, wavy boundary.

R—16 inches, olive (5Y 4/3), fractured, frost-churned shale that has fragments as much as 6 inches long; few, thin, clay patches on shale fragments; slightly acid.

The solum ranges from 12 to 18 inches in thickness. Depth to churned shale bedrock is 10 to 20 inches (fig. 25). The content of coarse fragments is more than 35 percent.

Figure 25.—Representative profile of Weikert channery silt loam. Frost-churned bedrock is at a depth of about 1 foot.

The Ap horizon ranges from very dark grayish brown to brown. The B2 horizon ranges from brown to yellowish brown.

Weikert soils in Northampton County have a somewhat higher pH than is defined for the series, but this difference does not affect their use, management, or behavior.

Weikert soils, the moderatley deep, well-drained Berks soils, the deep, well-drained Bedington soils, the deep, moderately well drained to somewhat poorly drained Comly soils, and the poorly drained Brinkerton soils formed in similar material.

Weikert channery silt loam, 3 to 8 percent slopes (WkB).—This soil is on slightly convex hillsides and ridgetops. The areas range from 2 to more than 25 acres in size. This soil has a profile similar to the one described as representative for the series, but fewer coarse fragments are throughout.

Included with this soil in mapping were small areas of soils that have a moderately fine textured subsoil and a firm substratum. A few of these included areas are over limestone. Also included were areas of severely eroded soils, areas of soils that have fractured shale bedrock at a depth of more than 20 inches, and areas of soils that have a shaly silt loam surface layer.

Low available moisture capacity and a channery texture severely limit the kinds of crops that can be grown on this soil. Depth to bedrock and the presence of channery fragments are the major limitations to most nonfarm uses. Capability unit IIIe-4.

Weikert channery silt loam, 8 to 15 percent slopes (WkC).—This soil is on convex hillsides and ridgetops. The areas are irregular in shape and range from 2 to more than 50 acres in size. This soil has the profile described as representative for the series. Cultivated areas are moderately to severely eroded (fig. 26).

Figure 26.—A field of Weikert channery silt loam, 8 to 15 percent slopes, that has been severely eroded. The channery fragments on the surface hinder cultivation.

Included with this soil in mapping were small areas of soils that have a moderately fine textured subsoil and a firm substratum. In places these included areas are underlain by limestone. Also included were areas where the content of

coarse fragments in the surface layer is more than 50 percent and areas that are more than 20 inches deep over shale bedrock.

Low available moisture capacity, high erosion hazard, and channery texture severely limit the kinds of crops that can be grown on this soil. This soil is better suited to hayland than to cultivated crops. Shallowness to bedrock, steepness of slope, and the many channery fragments are major limitations to most nonfarm uses. Capability unit IVe-3.

Weikert channery silt loam, 15 to 25 percent slopes (WkD). —This soil is on convex hillsides and ridges. The areas are irregular in shape and range from 2 to more than 50 acres in size. The profile of this soil is thinner, and in many places the surface layer contains a higher precentage of coarse fragments. This soil is moderately to severely eroded, and the hazard of further erosion is very high. Rills and gullies are common.

Included in mapping were areas where the surface layer is 50 percent coarse fragments and areas of soils that are more than 20 inches deep over shale bedrock.

Moderately steep slopes, low available moisture capacity, the very high erosion hazard, and a channery texture limit the suitability of this soil for pasture and trees. Shallowness to bedrock, the many channery fragments, and steepness of slope are major limitations to most nonfarm uses. Capability unit VIe-1.

Wurtsboro Series

The Wurtsboro series consists of deep, moderately well drained, gently sloping to moderately steep soils on uplands. These soils formed in compact glacial till composed of material weathered from quartzite, sandstone, shale, and small amounts of limestone. This till is primarily deposited over shale and slate uplands.

In a representative profile the surface layer is dark grayish-brown gravelly silt loam about 11 inches thick. The upper part of the subsoil, between a depth of 11 and 28 inches, is friable, yellowish-brown gravelly loam that contains light brownish-gray and yellowish-brown mottles in the lower part. Between a depth of 28 and 76 inches is a yellowish-brown gravelly loam fragipan that is firm and brittle that contains common, distinct, light brownish-gray and strong-brown mottles.

Permeability is moderately slow. Available moisture capacity is low. A water table is within a depth of 1 1/2 to 3 feet during wet seasons. During periods of heavy rainfall and spring thaws, the soils in depressions and drainageways are ponded in many places.

Most areas of Wurtsboro soils are farmed, but some extremely stony areas are wooded; other areas are idle or are used for residential and recreational activities. Low available moisture capacity, restricted permeability, a seasonal high water table, a high content of coarse fragments, and steepness of slope are major limitations to use.

Representative profile of Wurtsboro gravelly silt loam, 2 to 8 percent slopes, in a cultivated field, one-half mile south of East Bangor in Washington Township. (This is profile S67P-48-8 (1-8) for which physical and chemical data are given in tables 11 and 12.):

Ap—0 to 11 inches, dark grayish-brown (2.5Y 4/2) gravelly silt loam; moderate, medium and coarse, granular structure; very friable, slightly sticky, plastic; 15 percent gravel as much as 2 1/2 inches in diameter; medium acid; abrupt, smooth boundary.

B21—11 to 20 inches, yellowish-brown (10YR 5/6) gravelly loam; weak, medium and coarse, subangular blocky structure; friable, slightly sticky, plastic; few thin clay films in large pores; many root and worm channels filled with material from the Ap horizon; 15 percent gravel as much as 2 1/2 inches in diameter; slightly acid; clear, wavy boundary.

B22—20 to 28 inches, yellowish-brown (10YR 5/6) gravelly loam; common, medium, distinct mottles of light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8); weak, coarse, subangular blocky structure; friable, slightly sticky, plastic; few thin clay films in the larger pores; 20 percent gravel as much as 3 inches in diameter; medium acid; clear, wavy boundary.

Bx1—28 to 33 inches, yellowish-brown (10YR 5/4) gravelly loam; common, medium, distinct mottles of light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) in interiors; continuous ped coatings of light brownish gray (10YR 6/2) that have light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6 and 5/8) coatings on prism faces; moderate, very coarse, prismatic structure parting to weak, very thick, platy; firm, brittle, slightly sticky, plastic; few thin clay films in larger pores; 30 percent gravel and 5 percent cobblestones; medium acid; clear, wavy boundary.

Bx2—33 to 39 inches, yellowish-brown (10YR 5/4) gravelly loam; continuous, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6 and 5/8) coatings on the coarse prism faces; moderate, very coarse, prismatic structure that parts to weak, very thick, platy; firm, brittle, slightly sticky, plastic; many thick and moderately thick clay films in pores; few, thin, clay film patches on tops of plates; few black coatings of iron and manganese; 30 percent gravel and 5 percent cobblestones; strongly acid; gradual, wavy boundary.

Bx3—39 to 51 inches, yellowish brown (10YR 5/4) gravelly loam; continuous, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6 and 5/8) coatings on prism faces; moderate, very coarse, prismatic structure that parts to weak, very thick, platy; firm, brittle, slightly sticky, plastic; many moderately thick clay films in pores, few, thin, clay film patches on tops of plates; common, coarse, black, iron and manganese coatings; 30 percent gravel and 10 percent cobblestones; strongly acid; gradual wavy boundary.

Bx4—51 to 62 inches, yellowish-brown (10YR 5/4) very gravelly loam; few, fine distinct, mottles of light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6); light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6 and 5/8) coatings on prism faces; moderate, very coarse, prismatic structure that parts to weak, medium and thick, platy; firm, brittle, slightly sticky, plastic; many, moderately thick clay films in pores; common, coarse, black, iron and manganese coatings; 40 percent gravel, 15 percent cobblestones, and 5 percent stones; strongly acid; gradual, wavy boundary.

Bx5—62 to 76 inches, yellowish-brown (10YR 5/4) very gravelly loam, common, medium, distinct mottles of light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6); light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/6 and 5/8) coatings on prism faces; moderate, very coarse, prismatic structure that parts to weak, medium and thick, platy; firm, brittle, slightly sticky, plastic; many moderately thick clay films in pores; few, thin and moderately thick, clay film patches on tops of plates; many, coarse, black, iron and manganese coatings on the plates; 40 percent gravel, 15 percent cobblestones, and 5 percent stone; strongly acid.

The solum ranges from 54 to more than 90 inches in thickness. Depth to hard bedrock is more than 5 feet, and in some places it is more than 20 feet. Depth to the fragipan ranges from 20 to 30 inches. Coarse fragment content ranges from 10 to 35 percent in the B21 and B22 horizons and from 35 to 70 percent in the Bx and Bx5 horizons. The B horizon ranges from pale brown to light olive brown and has mottles that range from gray to yellow.

The Wurtsboro soils in Northampton County have a higher pH and the fragipan is at a depth slightly more than is defined for the series, but these differences do not alter their use, management, or behavior.

Wurtsboro soils, the well-drained Swartswood soils, the somewhat poorly drained Volusia soils, and the poorly drained Chippewa soils formed in similar material. Wurtsboro soils are similar to Buchanan, Comly, Urbana, Phelps, and Clarksburg soils in drainage. The Buchanan, Comly, Urbana, Phelps, and Clarksburg soils have a Bt horizon.

Wurtsboro gravelly silt loam, 2 to 8 percent slopes (WuB). —This soil is on broad, undulating uplands and toe slopes and in drainageways and depressions. The areas are oval,

oblong, or irregular in shape. They range from 5 to more than 50 acres in size. This soil has the profile described as representative for the series. Runoff is moderate, and small rills are common.

Included with this soil in mapping were some areas where plowing has mixed material from the subsoil with that in the surface layer.

If these soils are artificially drained, they are suited to all crops commonly grown in the county, but alfalfa and small grain are affected by frost heaving. Moderately slow permeability, a seasonal high water table, and a high gravel content are major limitations to most nonfarm uses. Capability unit IIw-2.

Wurtsboro gravelly silt loam, 8 to 15 percent slopes (WuC). —This soil is on broad, rolling uplands and on smooth lower toe slopes of ridges. The areas are irregular in shape and range from 2 to more than 25 acres in size. The profile of this soil is similar to the one described as representative for the series, but it has a thinner surface layer and more coarse fragments. Cultivated areas are moderately to severely eroded. The erosion hazard is high. Gullies are common, particularly below spring seeps.

If this soil is protected from erosion, it is suited to most crops commonly grown in the county. Moderately slow permeability, a seasonal high water table, a high gravel content, and steepness of slope are major limitations to most nonfarm uses. Capability unit IIIe-2.

Formation and Classification of the Soils

This section discusses the factors and processes of soil formation, describes the major soil horizons, and shows the classification of the soils of the county according to current standards.

Factors of Soil Formation

Soils form through the interaction of five major factors: parent material, climate, plant and animal life, topography, and time. The relative influence of each factor varies from place to place. In places one factor may dominate the formation of a soil and determine most of its properties. In Northampton County local variations in soils are due primarily to differences in kind of parent material and in topography and drainage.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It determines the initial mineralogical and chemical composition of the soil and influences the rate and balance of soil forming processes that take place.

In Northampton County, soils formed in glacial till, residuum, colluvium, a mixture of glacial till and frost-churned residuum, a mixture of glacial till and colluvium, glacial outwash, old alluvium, recent stream alluvium, and some organic materials. Most of the soil material was deposited or influenced by the glaciers, which melted 10,000 to 60,000 years ago. Alluvial and organic material are of recent origin and are being deposited at the present time.

Soils that formed in a mixture of glacial till and frost-churned residuum are the most extensive and have a wide range of characteristics. The Washington, Clarksburg, and Bedington are examples of these soils. Examples of soils that formed in residuum are Conestoga and Hollinger. Soils that formed entirely in glacial till are confined to the northeastern corner of Northampton County. A compact subsoil is their distinguishing characteristic. The Swartswood, Wurtsboro, and Volusia soils are examples. Soils that formed in colluvium and a mixture of glacial till and colluvium are at the base of Blue Mountain. These soils are Laidig, Buchanan, and Andover. Soils that formed in glacial outwash deposits and on old high river terraces are generally underlain by sand and gravel. Examples of these soils are Conotton, Red Hook, and Halsey. Soils on the stream bottoms formed in water-laid material called recent alluvium. They have little or no profile development. Examples of these soils are Barbour, Middlebury, and Holly. An example of a soil that formed in organic material is Muck.

Climate

The climate of Northampton County is of the humid continental type. It affects the formation of soils through its influence on the rate that rock weathers and the minerals and organic matter decompose. For additional information on climate, see "Climate" in the section General Nature of the County.

Plant and animal life

Living organisms are important to soil formation. These include vegetation, animals, bacteria, and fungi. The vegetation is generally responsible for the amount of organic matter, color of the surface layer, and the amount of nutrients. Animals such as earthworms, cicada, and burrowing animals help keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing nutrients for plants. In Northampton County the native forests have had profound influence on soil formation. Man, however, has greatly influenced the soil surface where he has cleared the forests and plowed the land. He has added fertilizers, mixed some of the soil horizons, and has even moved soil material from place to place.

Topography

Most of the soils of Northampton County have been significantly affected by glaciation; consequently, topography has had a somewhat different effect on soil formation in this county than in some others. Northampton County has five fairly distinct topographic areas (fig. 27). Smaller amounts of till were deposited in area 3, which is hilly and sharply dissected, than in area 2, which is gently rolling and smoothly dissected, or area 4, which is nearly level to gently rolling. Some of the steeper areas on Blue Mountain are devoid of soil. Area 5, which is made up of unglaciated, smoothly dissected, hilly uplands, is characterized by deep soils.

Generally, within topographic divisions, the classic topographic influence exerts itself on the formation of the soils. Soils formed on sloping areas where runoff is moderate to rapid generally are well drained, have a brightly colored unmottled subsoil, and in most places are leached to greater depth than wetter soils in the same general area. The Bedington, Berks, and Conestoga soils are examples. In more gently sloping areas where runoff is slower, the soils generally exhibit some evidence of wetness, such as subsoil mottling. The Comly, Buchanan, and Urbana soils are examples. In depressions where the water table is at or near the surface for long periods, the soils show evidence of wetness to a marked degree. They have a dark-colored surface layer

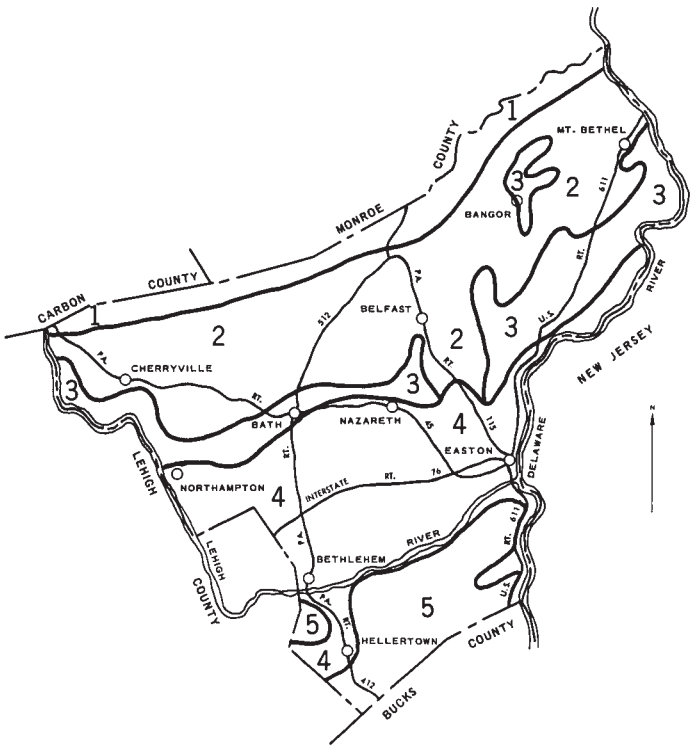

Figure 27.—Topographic areas in Northampton County.

and strongly mottled or grayish subsoil. The Brinkerton, Baile, neutral variant, and Chippewa soils are examples.

Time

The effect of plants and animals, climate, and topography in changing parent material into soil is governed by the length of time these factors have acted on the parent material. The degree of profile development generally indicates the age of a soil.

The Barbour, Middlebury, and Holly soils, which are on flood plains are younger than other soils of the county. Organic matter has accumulated on the surface of these soils, but their subsoil is less distinct than that in soils on uplands and terraces. The soils on glaciated uplands show two distinct time differences. The soils that formed in Illinoian glacial material have moderate to distinct subsoil horizon development. Examples of soils of this glacial era are the Washington and Bedington soils. The younger soils that formed in Wisconsin glacial material, however, show only moderate to slight subsoil horizon development and do not have argillic horizons. The soils of the Swartswood, Wurtsboro, and Volusia series are in this category. The oldest soils in the county are nonglaciated. They are in the southern part of the county and have well-developed, distinct argillic horizons. The Conestoga and Urbana soils are examples of these soils.

Processes of Horizon Differentiation

Several processes are involved in the formation of horizons in the soils of Northampton County. These processes include the accumulation of organic matter, the leaching of soluble salts, the reduction and translocation of iron, the formation of soil structure, and some translocation and loss of clay minerals, aluminum, silica, and iron. These processes are continually taking place and generally at the same time throughout the profile.

The accumulation of organic matter takes place with the decomposition of plant residue. This process darkens the surface layer and helps to form the A1 horizon.

It is believed that leaching of lime and other soluble salts preceeds the translocation of clay minerals. Many factors affect leaching, such as the kinds and amounts of salts originally present, the depth to which the soil solution percolates, and the texture of the soil material.

An important process of horizon differentiation in Northampton County is the formation and translocation of clay minerals. The kinds and amount of clay minerals in a soil profile are dependent on the kind and amount of minerals in the parent material. The amount of clay varies from one soil horizon to another. Clay minerals are generally moved from the A horizon down into the B horizon. Evidences of such movement are greater clay content of the B horizon and clay films on the ped faces, in the pores, and along root channels in many soils. Clay films in the B2t horizon of Conestoga silt loam are evidence of clay mineral translocation.

The oxidation and reduction of iron is associated mainly with the depth to the water table. The bright-brown or reddish-brown B horizon of well-drained soils, such as the Washington and Bedington soils, indicates the presence of oxidized iron compounds and the absence of a water table within the profile. Brownish or reddish soils that have gray mottles indicate a reduction of iron caused by a seasonal high water table. Poorly drained soils, such as Brinkerton, have a grayish B horizon indicative of a reduction of iron caused by a year-round high water table.

Fragipans have formed in the B horizon of many moderately well and somewhat poorly drained soils, such as the Wurtsboro, Volusia, and Comly soils. These fragipans are firm and brittle when moist and hard when dry. Clay, silica, and oxides of aluminum are generally the cementing agents that cause the brittleness and hardness. Soil particles are so tightly packed that bulk density is high, and pore space is low.

Major Soil Horizons

The results of the soil-forming processes are reflected in the different horizons developed in a soil profile. The soil profile extends from the surface downward to materials that are little altered by the soil-forming processes.

Most soils contain three major horizons: A, B, and C. These horizons can be subdivided by the use of numbers and letters to indicate changes within one horizon. An example is the B2t horizon, a layer within the B horizon with translocated clay illuviated from the A horizon.

The A horizon is the surface layer. It contains the A1 horizon, which has the largest accumulation of organic matter. It also contains the A2 horizon, which is the horizon of maximum leaching or eluviation of clay and iron. The A2 horizon of some soils in Northampton County is brownish in color because of the oxidation of iron.

The B horizon lies underneath the A horizon and commonly is called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or oth-

er compounds leached from the A horizon. In some soils the B horizon forms through alteration in place rather than from illuviation. The alteration may be due to oxidation and reduction of iron or the weathering of clay minerals. The B horizon has blocky or prismatic structure and generally is firmer and lighter colored than the A1 horizon, and darker colored than the C horizon.

The C horizon is below the A and B horizons. It consists of materials that may have been modified by weathering, but it is relatively unaffected by the biological and physical changes and many of the chemical changes involved in the formation of the A and B horizons.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in a detailed soil survey and for application of knowledge in managing farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

The current system of soil classification defines soils in terms of observable or measurable properties (*20*). The system currently used and described in this section was adopted for general use by the National Cooperative Soil Survey in 1965. This system is under continual study. Therefore, readers interested in the development of the system should search for the latest literature available (*19, 20*).

The current system of classification has six categories. Beginning with the most inclusive, these categories are order, suborder, great group, subgroup, family, and series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 10 shows the classification of each soil series of Northampton County by family, subgroup, and order, according to the current system. The categories in this system are described in the paragraphs that follow.

ORDERS.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions to this are Entisols, Histosols, and, to some extent, Inceptisols, which occur in many different climates.

As shown in table 10, five soil orders are represented in Northampton County: Inceptisols, Ultisols, Alfisols, Histosols, and Entisols.

Typical *Inceptisols* have a surface layer that has been darkened to a depth of several inches by organic matter. The B horizon has uniform color, weak to moderate structure, and little if any accumulation of silicate clay. Many inceptisols have a fragipan. The soils of this order range from very poorly drained to well drained. In Northampton County, examples of Inceptisols are soils of the Barbour, Berks, and Volusia series.

Typical *Ultisols* and *Alfisols* also have a surface layer that has been darkened to a depth of several inches by organic matter. The B horizon has measurably more clay than the A horizon and a moderate to strong structure. In some soils it has a fragipan. Ultisols are lower in base saturation than Alfisols. In Northampton County, Alfisols and Ultisols are higher than normal in base saturation as a result of liming and of air pollution from steel mills, limestone kilns, and cement plants. The soils in these orders range from poorly drained to well drained. Brinkerton, Conotton, and Urbana soils are examples of Alfisols. Andover and Laidig soils are examples of Ultisols.

Histosols are organic soils. The order is represented in Northampton County by Muck, which has a surface layer of muck over peat. Areas of Muck soils are saturated most of the year.

Entisols are the youngest soils in Northampton County. They show little evidence of horizon development other than a darkening of the A horizon. In Northampton County this order is represented only by the Holly series.

SUBORDERS.—Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes with the greatest genetic similarity. The climatic range is narrower than that of the order. The soil properties considered are mainly those that reflect either the presence or absence of waterlogging or differences in climate or vegetation.

GREAT GROUPS.—Each suborder is divided into great groups on the basis of differences in the kinds and sequence of major soil horizons and features. The horizons considered are those in which clay, iron, or humus have accumulated or those that have pans that interfere with growth of roots or movement of water. Examplesof the features considered are the self-mulching properties of clays, soil temperature, and major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium).

SUBGROUPS.—Each great group is divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of the group and also have one or more properties of another group, suborder, or order. A subgroup may also be set up if a soil has properties outside the range of any other great group, suborder, or order.

FAMILIES.—Families are established within each subgroup, primarily on the basis of properties important to the growth of plants or the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistency.

Laboratory Data[6]

Data on the physical and chemical properties and clay mineralogy of soil profiles representing the Swartswood, Wurtsboro, Volusia, and Chippewa series are given in tables 11 and 12(*6*). The site of the sample for each soil was in the extreme northeastern part of the county. Profiles were selected that most nearly represent the series in morphological characteristics, slope, susceptibility to erosion, and land use. The soil morphology at each site was described. Samples of each horizon described were collected and analyzed.

[6] Laboratory analyses and interpretations were made at the Soil Characterization Laboratory at the Pennsylvania State University by R. L. CUNNINGHAM, G. W. PETERSEN, R. W. RANNEY, R. P. MATELSKI, and E. J. CIOLKOSZ.

TABLE 10.—*Classification of the soil series by higher categories*

Series	Family	Subgroup	Order
Andover 1/	Fine-loamy, mixed, mesic	Typic Fragiaquults	Ultisols.
Baile, neutral variant	Fine-loamy, mixed, mesic	Typic Ochraqualfs	Alfisols.
Barbour 2/	Coarse-loamy over sandy or sandy skeletal, mixed, mesic.	Fluventic Dystrochrepts	Inceptisols.
Bedington 2/	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Berks	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Brinkerton 3/	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols.
Buchanan 2/	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols.
Chippewa 4/	Fine-loamy, mixed, mesic	Typic Fragiaquepts	Inceptisols.
Clarksburg 2/	Fine-loamy, mixed, mesic	Typic Fragiudalfs	Alfisols.
Comly 2/	Fine-loamy, mixed, mesic	Typic Fragiudalfs	Alfisols.
Conestoga	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Conotton	Loamy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Duffield 2/	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Halsey 5/	Coarse-loamy over sandy or sandy skeletal, mixed, nonacid, mesic.	Mollic Haplaquepts	Inceptisol
Hollinger	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Holly	Fine-loamy, mixed, nonacid, mesic	Typic Fluvaquents	Entisols.
Laidig 2/	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols.
Middlebury	Coarse-loamy, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols.
Muck		Fibric Medihemist, Terric Medihemist.	Histosols.
Phelps, thick solum variant	Fine-loamy, mixed, mesic	Aquic Hapludalfs	Alfisols.
Red Hook 2/	Coarse-loamy, mixed, acid, mesic	Aeric Haplaquepts	Inceptisols.
Ryder	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Swartswood 6/	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Urbana 7/	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Volusia 6/	Fine-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Washington	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Weikert 2/	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols
Wurtsboro 8/	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.

1/ Taxadjunct: Slightly more silt in the Bt horizon than defined for the series.

2/ Taxadjunct: Slightly higher pH than defined for the series.

3/ Taxadjunct: Higher content of fine sand in the B2tg horizon than defined for the series.

4/ Taxadjunct: Slightly thicker solum and higher color values in the fragipan than defined for the series.

5/ Taxadjunct: Slightly higher clay content in the control section than defined for the series.

6/ Taxadjunct: Slightly thicker solum than defined for the series.

7/ Taxadjunct: Low-chroma mottles at slightly greater depth and fewer schistose coarse fragments than defined for the series.

8/ Taxadjunct: Slightly higher pH and a fragipan beginning at slightly greater depth than defined for the series.

The profiles sampled differ from modal profiles of the series in the following respects: Chippewa soils have a slightly thicker solum and higher color values in the fragipan; Swartswood and Volusia soils have a slightly thicker solum; and Wurtsboro soils have a slightly higher pH and a fragipan beginning at a slightly greater depth.

Methods of Analyses

Soil samples of about 3,000 to 4,000 cubic centimeters were collected from each horizon described. Coarse fragments more than 12.7 millimeters in diameter were sieved and weighed in the field. In the laboratory, air-dry samples were sieved for coarse fragments between 12.7 and 2 millimeters in diameter and weighed. Coarse fragment data are presented as a percentage, by weight, based on the total bulk sample.

The particle-size distribution of the material that passed through a 2 millimeter sieve was determined by the pipette method of Kilmer and Alexander (*10*) and presented as a percentage, by weight, based on the total amount of material less than 2 millimeters in diameter.

Triplicate natural clods weighing about 100 to 300 grams were taken from each horizon and tested to determine bulk density and water retention at 1/3-atmosphere tension (*5*). Bulk density of the material smaller than 2 millimeters is calculated by subtracting the weight and volume of the coarse fragments. The percentage of moisture (by weight) retained at 1/3-atmosphere tension is similarly calculated. Using the percentage of moisture retained at 15-atmosphere tension (*17, 26*), and correcting for the coarse-fragment content as measured in the bulk sample, the available moisture capacity was calculated by the following equation:

$$(a - b)\frac{x}{100} = \text{available moisture capacity (percent by weight)}$$

where a = the percentage of water retained at 1/3-atmosphere tension in material smaller than 2 millimeters; b = the percentage of water retained at 15-atmosphere tension in the same material; and x = the percentage of material less than 2 millimeters in diameter contained in the bulk sample. In these calculations, it is assumed that water is not held by coarse fragments.

Soil pH of the sieved samples was measured in the laboratory in a 1:1 soil:water mixture, using a pH meter and glass electrode.

Organic carbon was determined by ignition in a Fisher induction-carbon apparatus, collecting the evolved CO_2 (*25*). Nitrogen was determined by the Kjeldahl method (*3*).

Cations were extracted with a neutral, normal NH_4OAc solution (*16*). Calcium (Ca) and magnesium (Mg) were determined by atomic-absorption spectrophotometry, and sodium (Na) and potassium (K) by flame-emission spectrophotometry. A barium chloride-triethanol-amine extract, pH 8.1, was titrated with 0.05 N HCl to determine exchangeable acidity (*13*). The sum of the bases (Ca, Mg, Na, and K) and the exchangeable acidity equals the cation exchange capacity (CEC). The sum of the bases divided by CEC and multiplied by 100 equals percent base saturation.

Iron oxides were estimated by sodium dithionite-citrate-bicarbonate extraction and determination of the iron colorimetrically with o-phenanthroline (*14*). Aluminum was extracted by *N* KCl solution and determined by aluminon colorimetry (*8*).

Clay minerals were identified on a Norelco x-ray diffractometer equipped with a Geiger counter and chart recorder using a copper target. Prior to x-ray analysis, the air-dry sieved samples were treated with 10 percent hydrogen peroxide to remove organic matter, and iron oxides were removed by sodium dithionite-citrate-bicarbonate extraction. Clay samples (< 2 microns) were separated by centrifugation, and flat-oriented clays were analyzed at room temperature with water and ethylene glycol solvation. Potassium-saturated clays were water solvated and analyzed at 300° C. and 550°C., as well as at room temperature. The traces were interpreted on the basis of peak height and relationship to known clay mixtures, and estimates were made to the nearest 5 or 10 percent.

Summary of Data

Large amounts of coarse fragments, fragipans, and restricted permeability are important features of the soils sampled. The absence of argillic B horizons is also characteristic of these soils. Low fertility levels are suggested by the chemical data.

The Swartswood, Wurtsboro, Volusia, and Chippewa soils formed in medium-textured or moderately coarse textured glacial till derived largely from shale, siltstone, sandstone, quartzite, and small amounts of limestone. Swartswood soils are well drained, Wurtsboro soils are moderately well drained, Volusia soils are somewhat poorly drained, and Chippewa soils are poorly drained. All are Inceptisols that have fragipans. The better drained Swartswood and Wurtsboro soils are in coarse-loamy, mixed, mesic families, whereas Volusia and Chippewa soils are members of fine-loamy, mixed, mesic families.

In addition to the presence of the fragipan in these four soils, another important feature is the high content of coarse fragments. This high proportion of coarse fragments decreases fertility and available moisture capacity in addition to causing tillage problems.

Relative uniformity of clay content with depth is a feature of these soils, with the exception of the Chippewa soils. Chippewa soils have an accumulation of clay in the surface layer as the result of fine particles washing in from higher surrounding soils. Sand content generally increases with depth, and the silt content decreases. A possible explanation is that severe weathering near the surface tends to reduce particles into silt sizes. None of these profiles has enough clay movement to form an argillic horizon, but some thin clay films were observed on fragments and in pores.

The textures are generally considered favorable for water, root, and air penetration; however, because of particle arrangement below the subsurface horizon, little penetration occurs. This close packing is reflected in the relatively high bulk density of the Bx horizon. This horizon, called a fragipan, restricts internal movement even though the properties of the surface layer are favorable for the intake of water and air and for the growth of plant roots. Water and roots move primarily along prism faces because of the high bulk density within the prisms in the fragipan.

Bulk density and the number of coarse fragments in the profile increase with increasing depth. Available moisture capacity is adequate in the upper part of the profile, but decreases with increasing depth, and the total storage capacity of water in the profile tends to be low.

With restricted drainage, base saturation tends to increase. The well-drained Swartswood soils are extremely

TABLE 11.—*Mechanical analysis and*

[Dashes in columns indicate sample not

Soil series and sample number	Horizon	Depth from surface	Particle-size distribution				
			Very coarse sand (2.0 to 1.0 mm.)	Coarse sand (1.0 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)
		In.	Pct.	Pct.	Pct.	Pct.	Pct.
Chippewa:							
S67 Pa 48-17-1	A11	0-5	1.0	2.3	6.0	7.6	7.7
S67 Pa 48-17-2	A12	5-9	6.0	5.5	8.6	10.6	5.3
S67 Pa 48-17-3	B21g	9-11	2.3	5.3	8.8	10.5	9.9
S67 Pa 48-17-4	B22g	11-17	3.4	6.3	9.2	12.9	8.8
S67 Pa 48-17-5	Bx1g	17-28	4.8	12.3	5.2	11.7	11.8
S67 Pa 48-17-6	Bx2g	28-41	7.1	8.3	10.0	12.9	10.6
S67 Pa 48-17-7	Bx3g	41-54	5.5	8.3	9.7	11.6	12.9
S67 Pa 48-17-8	Bx4g	54-64	7.0	7.0	9.6	13.2	10.2
S67 Pa 48-17-9	Bx5g	64-80+	5.4	6.7	9.0	12.6	11.1
Swartswood:							
S67 Pa 48-32-1	02	1-0	3.4	6.0	7.6	10.6	11.6
S67 Pa 48-32-2	A1	0-2	4.0	10.5	7.8	6.5	11.9
S67 Pa 48-32-3	B1	2-9	9.1	7.6	8.3	4.1	16.7
S67 Pa 48-32-4	B2	9-20	11.6	8.8	9.4	11.3	9.9
S67 Pa 48-32-5	Bx1	20-26	6.3	9.4	12.0	14.2	11.7
S67 Pa 48-32-6	Bx2	26-42	8.5	10.4	12.4	15.2	11.0
S67 Pa 48-32-7	Bx3	42-52	8.0	10.2	13.2	15.7	11.8
S67 Pa 48-32-8	Bx4	52-64	9.2	12.4	13.2	15.0	10.7
S67 Pa 48-32-9	Bx5	64-75	8.2	11.3	13.8	19.0	12.7
S67 Pa 48-32-10	Bx6	75-88	10.8	10.7	13.9	17.2	11.7
Volusia:							
S67 Pa 48-26-1	AP	0-9	6.4	4.5	4.8	5.2	7.3
S67 Pa 48-26-2	B2	9-17	4.6	4.8	5.6	5.4	9.5
S67 Pa 48-26-3	Bx1g	17-27	9.0	7.1	7.9	9.2	8.5
S67 Pa 48-26-4	Bx2g	27-39	4.9	7.0	8.2	9.7	10.0
S67 Pa 48-26-5	Bx3g	39-50	6.3	6.5	8.1	9.5	8.6
S67 Pa 48-26-6	Bx4g	50-57	8.0	7.5	9.6	6.3	12.2
S67 Pa 48-26-7	Bx5g	57-67	7.3	8.1	9.0	10.0	8.1
S67 Pa 48-26-8	Bx6g	67-81	10.4	8.1	8.8	8.9	9.4
Wurtsboro:							
S67 Pa 48-8-1	AP	0-11	3.0	3.4	4.6	6.6	9.1
S67 Pa 48-8-2	B21	11-20	3.9	5.1	5.9	7.4	9.6
S67 Pa 48-8-3	B22	20-28	3.9	6.5	7.5	9.0	10.8
S67 Pa 48-8-4	Bx1	28-33	2.7	3.1	3.3	3.9	7.7
S67 Pa 48-8-5	Bx2	33-39	5.5	6.0	9.2	9.2	5.7
S67 Pa 48-8-6	Bx3	39-51	6.5	6.7	9.7	11.5	10.4
S67 Pa 48-8-7	Bx4	51-62	6.9	7.1	8.9	10.7	10.7
S67 Pa 48-8-8	Bx5	62-76	6.1	7.4	9.4	12.4	9.9

low in base saturation and medium in acidity. The higher content of bases in the more poorly drained Volusia and Chippewa soils may be the result of enrichment by surface water and less intense leaching. The surface horizon is generally the highest in calcium, probably because of the influence of vegetation, which contains more calcium than magnesium. The cation content indicates that the fertility is low.

Organic carbon decreases with increasing depth in each profile and reflects the effects of vegetation, which is concentrated at the surface and decreases with depth.

The iron-oxide content remains nearly constant throughout all profiles. Chippewa soils have relatively high percentages in the upper three horizons, perhaps because of a high organic-matter content or wet conditions.

The clay composition shows a trend to relatively high amounts of vermiculite in the surface that decrease with depth, and illite and chlorite that tend to remain constant or to increase with depth. This trend is typical of Pennsylvania soils and represents a transformation of illite and chlorite to vermiculite in those horizons where weathering processes are the most intense. Kaolinite occurs in minor amounts. This clay mineralogy is typical of the till parent material where illite and chlorite are dominant.

General Nature of the County

Shortly before 1730 the first permanent settlers arrived in the area now known as Northampton County and started communities that were the forerunners of some of the present municipalities. Bethlehem is now the largest of these communities. Northampton County was the sixth county to be organized in the province of Pennsylvania. It was formed on March 11, 1752, from part of Bucks County. William

physical properties of selected soils

taken or material not present]

Particle-size distribution—Con.		Coarse fragments (larger than 2.0 mm.)	Bulk density (material less than 2 mm. in clods)	Moisture held at tension of—		Available moisture capacity (corrected for coarse fragments)
Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)			1/3 bar (material less than 2 mm., in clods)	15 bars	
Pct.	Pct.	Pct. by weight	Gm./cc.	Pct.	Pct.	In./in. of soil depth
44.1	31.4	0.2	0.95	43.7	30.5	0.13
38.3	25.7	2.7	1.18	26.2	16.3	.11
42.5	20.6	17.3	1.49	21.2	8.8	.16
42.0	17.4	22.1	1.65	18.2	5.7	.17
37.5	16.6	56.3	1.72	14.9	5.9	.08
33.7	17.3	45.1	1.75	14.1	5.6	.10
34.0	18.0	39.4	1.75	14.1	5.5	.10
35.9	17.1	46.9	1.76	15.4	5.6	.11
37.9	17.4	48.9	1.78	15.3	6.8	.09
48.2	12.7	2.5	---	---	35.4	---
47.3	12.0	58.1	.78	46.5	14.8	.16
41.3	13.1	31.5	1.44	20.9	4.8	.18
34.8	14.1	30.3	---	---	4.7	---
34.3	12.1	44.7	1.59	16.4	4.1	.13
28.2	14.3	77.2	1.72	12.4	4.9	.02
27.6	13.5	66.6	1.70	12.0	4.7	.05
27.7	11.8	82.8	1.78	10.9	4.5	.03
23.7	11.2	53.3	---	---	3.5	---
26.0	9.7	51.4	1.82	11.8	3.3	.06
53.3	18.5	25.7	1.36	25.9	9.6	.18
52.2	17.9	24.2	1.57	20.4	7.1	.17
40.6	17.7	39.5	1.72	16.5	5.5	.13
42.3	18.0	37.4	1.71	16.2	5.8	.12
42.2	18.9	40.1	1.77	15.9	6.0	.12
37.6	18.9	47.8	1.71	15.9	6.0	.10
39.8	17.8	69.2	1.66	18.2	6.2	.08
38.0	16.5	43.6	1.66	18.3	5.7	.14
58.3	14.9	18.2	1.34	22.6	10.0	.15
54.3	13.8	20.7	1.57	19.2	7.0	.16
48.9	13.5	25.9	1.60	18.8	7.1	.15
66.4	12.9	43.5	1.47	21.9	8.2	.14
51.9	12.5	54.5	1.75	14.2	7.2	.06
39.9	15.3	59.4	1.69	16.9	6.9	.08
40.7	15.0	61.0	1.71	14.7	6.4	.07
41.2	13.6	56.0	1.82	12.8	6.8	.06

Penn's son, Thomas, named the county in honor of this wife's ancestral home, Northamptonshire, England.

At first the county was mainly a farming area. Increasing farming activity in the region stimulated the growth of the towns and villages. Bethlehem, Easton, and Allentown (now in Lehigh County) were the important trade centers.

Industrial development began about 1830. It was advanced by the construction of canals along both the Lehigh and the Delaware Rivers and, after 1855, by the construction of railroads.

After 1890 changes were swift and numerous. The region became one of the nation's leading steel-, slate-, and cement-producing areas. The labor force drawn to the valley by these industries made the area attractive to other industries. The principal industrial products at present are steel, textiles, garments, cement, slate, and dehydrated alfalfa products.

Physiography, Drainage, and Geology

Northampton County is in the Ridge and Valley Provinces of the Appalachian Highlands (7). The area has three major landforms: (1) steep, high, generally narrow, mountainous ridges that run in a northeast-southwest direction and have large amounts of colluvial material at their bases; (2) rolling intermountain valleys that are underlain by shale; and (3) rolling uplands that are underlain by limestone.

The highest place in the county is the crest of Blue Mountain, which has a peak elevation of about 1,645 feet. The lowest is the point where the Delaware River leaves the county at an elevation of about 135 feet.

All streams of the county flow either directly into the Delaware River or into the Lehigh River, which joins the Delaware at Easton.

TABLE 12.—*Chemical properties*

[Dashes in columns indicate sample not taken or

Soil series and sample number	Horizon	Depth from surface	Organic carbon	Nitrogen	Carbon-nitrogen ratio	Calcium-magnesium ratio	Extractable cations				
							Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Acidity
		In.	Pct.	Pct.			Meq./100 gms. soil	Meq./100 gms. soil	Meq./100 gms. soil	Meq./100 gms. soil	Meq./100 gms. soil
Chippewa:											
S67 Pa 48-17-1	A11	0-5	6.01	0.51	11.8	5.6	17.7	3.2	0.1	0.5	28.6
S67 Pa 48-17-2	A12	5-9	1.96	.20	10.0	5.9	9.2	1.6	<.1	.2	15.2
S67 Pa 48-17-3	B21g	9-11	1.07	.11	9.5	4.9	4.8	1.0	<.1	.1	10.6
S67 Pa 48-17-4	B22g	11-17	.36	.06	6.1	---	1.8	.5	<.1	.1	5.1
S67 Pa 48-17-5	Bx1g	17-28	.11	---	---	1.4	2.1	1.6	<.1	.1	5.0
S67 Pa 48-17-6	Bx2g	28-41	.09	---	---	.9	1.9	2.2	<.1	.1	6.1
S67 Pa 48-17-7	Bx3g	41-54	.08	---	---	.7	1.7	2.3	<.1	.1	4.4
S67 Pa 48-17-8	Bx4g	54-64	.07	---	---	.8	1.9	2.5	<.1	.1	3.3
S67 Pa 48-17-9	Bx5g	64-80	.09	---	---	1.0	2.6	2.5	<.1	.1	3.0
Swartswood:											
S67 Pa 48-32-1	02	1-0	11.99	.79	15.1	9.7	25.3	2.6	.1	1.1	29.2
S67 Pa 48-32-2	A1	0-2	3.49	.24	14.3	---	1.8	.3	<.1	.4	27.1
S67 Pa 48-32-3	B1	2-9	.45	.05	8.6	---	.2	<.1	<.1	.1	8.6
S67 Pa 48-32-4	B2	9-20	.20	---	---	---	.1	<.1	<.1	.1	8.0
S67 Pa 48-32-5	Bx1	20-26	.11	---	---	---	<.1	<.1	<.1	.1	8.0
S67 Pa 48-32-6	Bx2	26-42	.07	---	---	---	.1	.1	<.1	.2	6.9
S67 Pa 48-32-7	Bx3	42-52	.08	---	---	---	.2	.1	<.1	.1	5.8
S67 Pa 48-32-8	Bx4	52-64	.08	---	---	---	.3	.1	<.1	.1	6.9
S67 Pa 48-32-9	Bx5	64-75	.07	---	---	---	.1	.1	<.1	.1	7.4
S67 Pa 48-32-10	Bx6	75-88	.07	---	---	---	.1	.1	<.1	.1	6.3
Volusia:											
S67 Pa 48-26-1	Ap	0-9	1.40	.15	9.4	---	3.2	.4	<.1	.1	10.5
S67 Pa 48-26-2	B2	9-17	.13	---	---	---	1.4	.4	<.1	.1	6.4
S67 Pa 48-26-3	Bx1g	17-27	.07	---	---	---	.4	.7	<.1	<.1	7.7
S67 Pa 48-26-4	Bx2g	27-39	.04	---	---	---	.7	1.4	<.1	<.1	6.9
S67 Pa 48-26-5	Bx3g	39-50	.04	---	---	.6	1.0	1.6	<.1	<.1	5.1
S67 Pa 48-26-6	Bx4g	50-57	.05	---	---	.7	1.1	1.5	<.1	.1	5.1
S67 Pa 48-26-7	Bx5g	57-67	.05	---	---	.9	1.1	1.2	<.1	.1	5.5
S67 Pa 48-26-8	Bx6g	67-81	.06	---	---	1.2	1.5	1.2	<.1	<.1	5.0
Wurtsboro:											
S67 Pa 48-8-1	Ap	0-11	1.14	.15	7.7	---	4.5	.3	<.1	.1	8.2
S67 Pa 48-8-2	B21	11-20	.21	---	---	---	2.6	.2	<.1	.1	5.8
S67 Pa 48-8-3	B22	20-28	.12	---	---	---	2.6	.3	.1	.1	4.7
S67 Pa 48-8-4	Bx1	28-33	.09	---	---	---	3.7	.6	<.1	.1	6.4
S67 Pa 48-8-5	Bx2	33-39	.06	---	---	---	2.4	.5	<.1	.1	6.1
S67 Pa 48-8-6	Bx3	39-51	.04	---	---	---	.7	.4	<.1	.1	7.1
S67 Pa 48-8-7	Bx4	51-62	.03	---	---	---	.8	.4	<.1	.1	7.5
S67 Pa 48-8-8	Bx5	62-76	.04	---	---	---	1.1	.5	<.1	.1	7.6

The surface rock in Northampton County formed during three geologic periods: the Cambrian (the oldest of the three), the Ordovician, and the Silurian (the most recent of the three). Rocks of all but one of these systems have at one time or another been commercially utilized (*9*), generally for building material.

One of the most important geologic formations in the county is the Beekmantown-Allentown-Tomstown limestone. This formation consists of interbedded, high-magnesium strata and low-magnesium strata. It is dominated in most areas by dolomitic stone. It has been quarried extensively. Crushed stone is the major product at present. In the past, this formation has supplied lime for farming and clay for bricks. Some deposits of iron ore have been found, but they are irregular in distribution and seem to be located where the limestone strata are closely folded or faulted.

The most valuable geologic formation in the county is the Ordovician Jacksonburg limestone, or cement rock (fig. 28). This formation extends across the entire county from Riverton to Northampton; small detached areas occur near Portland and Brodhead. The raw stone of this formation is composed of the kind of material necessary for the production of high-quality natural cement. As much as 40 percent of some townships is owned by companies engaged in quarrying cement rock. The quarries are very large.

The remaining geologic formation, the Martinsburg shale of the Ordovician system is economically fairly important. This shale is the basis of the slate industry (*9*).

of selected soils

material not present. The symbol < means less than]

Cation exchange capacity (sum)	Base saturation (sum)	Reaction (lab)	Free iron oxides (Fe_2O_3)	Mineral composition of clay fraction (particles <0.002 mm. in diameter)					
				Kaolinite	Illite	Vermiculite	Chlorite	Montmorillonite	Interstratified
Meq./100 gms. soil	Pct.	pH		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
50.1	42.9	5.8	3.5	5	20	60	5	---	10
26.2	42.1	6.1	4.6	---	---	---	---	---	---
16.5	35.7	6.1	3.1	---	---	---	---	---	---
7.5	32.2	6.1	1.7	5	45	10	25	---	15
8.8	43.0	5.7	1.5	5	65	10	10	---	10
10.3	40.6	5.7	1.5	---	---	---	---	---	---
8.5	47.9	6.3	1.5	10	70	10	10	---	---
7.8	57.5	6.8	1.6	---	---	---	---	---	---
8.2	63.3	6.8	1.8	10	65	10	10	---	5
58.4	49.8	5.7	---	---	---	---	---	---	---
29.6	8.4	5.0	1.3	---	15	55	5	---	25
9.0	4.5	5.0	1.5	---	---	---	---	---	---
8.2	2.9	4.9	1.7	---	45	10	35	---	10
8.2	2.2	4.8	1.6	---	50	5	35	---	10
7.2	4.5	4.9	1.7	---	---	---	---	---	---
6.2	7.0	5.1	1.7	---	60	---	30	---	10
7.5	7.4	5.1	1.5	---	---	---	---	---	---
7.7	3.4	5.1	1.3	---	60	---	30	---	10
6.6	3.8	5.1	1.3	---	60	---	30	---	10
14.3	26.4	5.9	1.7	5	20	50	10	---	15
8.3	22.7	5.6	1.7	5	45	20	15	---	15
8.9	13.8	5.3	1.8	5	60	15	10	---	10
9.1	24.4	5.5	1.7	---	---	---	---	---	---
7.8	34.7	5.5	1.8	5	65	10	10	---	10
7.7	34.0	5.4	1.9	---	---	---	---	---	---
7.9	30.4	5.6	1.9	10	70	5	10	---	5
7.7	35.3	5.5	1.8	5	80	5	10	---	---
13.2	37.9	5.8	---	---	---	---	---	---	---
8.7	33.2	6.3	1.8	---	---	---	---	---	---
7.7	38.8	6.2	2.0	10	55	10	5	---	20
10.9	41.0	6.0	2.0	10	50	10	10	---	20
9.2	33.5	5.7	2.0	---	---	---	---	---	---
8.2	13.4	5.2	1.9	10	65	---	10	---	15
8.8	14.8	5.4	1.9	---	---	---	---	---	---
9.3	18.4	5.6	1.9	10	70	---	10	---	10

Northampton County has long been the leader in the United States in the production of slate. Nine out of ten dimension slate quarries now active in Pennsylvania are located in Northampton County. Eight of the nine active quarries in the county are located in the Pen Argyl-Bangor area.

One frequently overlooked facet of the geologic history of Northampton County is the great glaciers, which at one time or another practically covered the county (*11*). Although these ice sheets were quite widespread, workable deposits of glacial sands and gravels are comparatively sparse, except in the vicinity of the Delaware River, where they occur as terraces, kames, and outwash (*24*).

The most extensive sand and gravel beds in the county are the kame deposits along Jacoby Creek near Mount Bethel. These are thick deposits of intermixed sand, gravel, and cobblestones.

Another extensive gravel and sand quarry is in a river terrace along the Delaware River north of Martins Creek. The deposit is 40 to 50 feet thick. The deposit lies upon limestone bedrock. Other minor deposits are found both north and south of Martins Creek along the Delaware River.

Water Supply

The water supply in the county varies, depending on the nature of the underlying rock.

The Martinsburg shale formation supplies water of good quality but of limited quantity. Springs, which are common

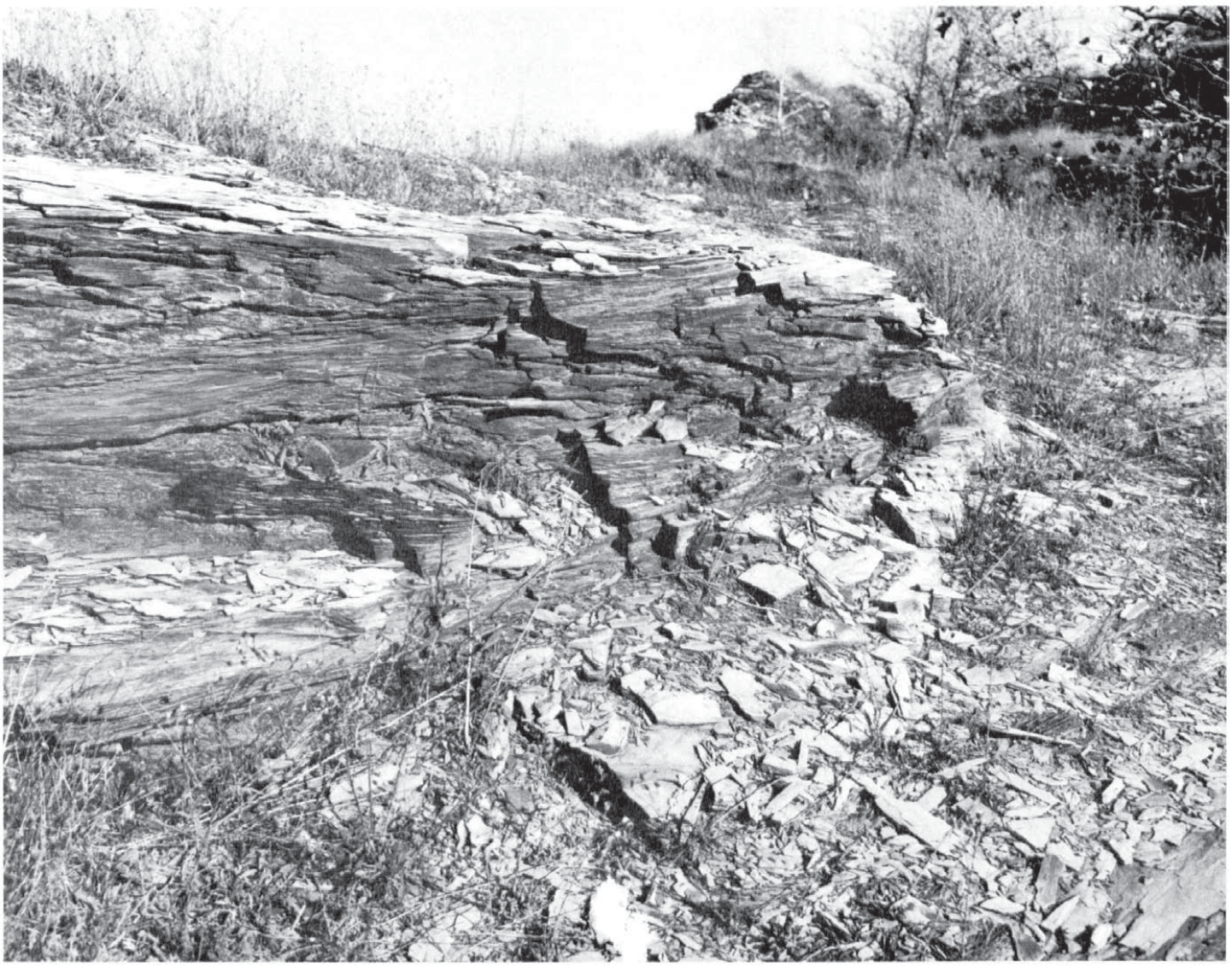

Figure 28.—Exposure of Jacksonburg limestone (cement rock). Note thin bedding typical of this formation.

in the areas underlain by this formation, are commonly used as supplementary sources of water.

In the areas underlain by the limestone formation, the quantity of water available is much greater, but the quality is questionable. Because the water travels through large solution channels, it is hard to locate, and it is easily contaminated by sewage, some of which is dumped into dry wells or sinks into the limestone.

Predictable water-producing strata are fewer in the southern part of the county than in other areas (*15*). In many spots good water has been obtained from Cambrian sandstone and Precambrian gneiss at a depth of less than 200 feet, but sand and mud flows hinder well drilling in some places. Springs that are good sources of water are fairly common.

Climate[7]

Northampton County is situated in the eastern extremity of the Pennsylvania East Central Mountains Climatic Division, and the climate is classified humid continental. Climatological data for the county are given in tables 13 and 14.

Most weather systems that affect this area originate in Canada or in the Central Plains of the United States. The primary moisture source for these weather systems is the Gulf of Mexico, although southerly and southeasterly flow off the Atlantic provides an added supply at times along the east coast of the United States.

[7]By PAUL DAILEY, State climatologist, National Weather Service, U.S. Department of Commerce.

TABLE 13.—*Temperature and precipitation data*

Month	Temperature				Precipitation					
						One year in 10 will have—		Snow		
	Average daily maximum	Average daily minimum	Average extreme maximum	Average extreme minimum	Average monthly total	Less than—	More than—	Average total	Average number of days with depth of—	
									1 inch	6 inches
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Inches		
January	38	25	56	8	3.1	1.7	5.3	6.4	10	2
February	40	24	58	7	2.6	1.8	3.8	7.2	10	3
March	48	31	69	16	3.6	2.1	4.9	4.6	4	1
April	62	41	83	29	3.6	1.9	5.6	0.4	(1/)	(1/)
May	73	51	89	38	3.7	1.6	5.8	0	0	0
June	82	60	95	48	3.7	1.7	5.5	0	0	0
July	86	65	97	54	4.5	1.2	7.0	0	0	0
August	84	63	95	51	4.5	2.2	7.1	0	0	0
September	77	56	91	41	3.5	0.9	7.0	0	0	0
October	66	46	84	32	3.0	1.2	5.9	0	0	0
November	53	36	70	21	3.4	0.9	4.9	1.6	1	(1/)
December	40	27	60	10	3.3	1.6	5.5	5.0	6	1
Year	62	44	2/104	3/-13	42.5	35.2	50.7	25.2	31	7

1/ Less than 0.5 day. 2/ Highest maximum period 1931-60. 3/ Lowest minimum period 1931-60.

TABLE 14.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Bethlehem, Northampton County, Pa.]

Probability	Dates of given probability of temperature of—				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 19	March 26	April 8	April 16	April 28
2 years in 10 later than	March 15	March 20	April 2	April 14	April 24
5 years in 10 later than	March 4	March 10	March 21	March 29	April 14
Fall:					
1 year in 10 earlier than	November 27	November 15	November 13	October 22	October 11
2 years in 10 earlier than	November 30	November 25	November 16	October 29	October 16
5 years in 10 earlier than	December 10	December 2	November 26	November 8	October 26

The influence of relief on climate is immediately apparent, particularly in the Blue Mountain area. Climatological data are not available for the higher parts of Blue Mountain, but an annual average temperature of 3° to 5° lower than surrounding lowlands is a reasonable estimate. Thus, the average annual temperature range over the county may be from 45°F. on the northern mountain ridges to 53° in the low-lying, urbanized Bethlehem area. Average annual precipitation also follows relief boundaries. Nearly 50 inches falls annually in the northern and eastern parts of the county and an average of 43 to 44 inches in the south and west-central parts. For the part of Blue Mountain in Northampton County, the average annual precipitation of 50 inches is probably accurate.

In summer the highest daytime temperature is in the low to mid 80's, and the lowest nighttime temperature is in the lower 60's. Extended periods of hot and humid conditions occur, and temperatures of more than 90° occur on an average of 24 days a year. Rarely does the temperature reach 100°. Freezing temperatures have not been recorded in Bethlehem in summer, and probably not for the rest of the county, except in areas along the Blue Mountain ridge. Cloud cover is at a minimum in summer. The county receives more than 60 percent of available sunshine, and nights are generally clear. The prevailing wind is southwest at 8 miles per hour. Afternoon and evening thundershowers occur on the average of 21 times in summer.

Winters are cold. Winds prevail from the west to northwest at an average speed of 11 miles per hour. Daytime highs average in the mid to upper 30's, and nighttime lows generally are in the lower 20's. Temperatures of 70° have been reported in winter, but they are rare. Subzero readings are also rare and occur on an average of only once or twice a year in most areas. They are somewhat more frequent in the mountains.

The first significant snowfall generally occurs in December, however, a few storms in November have produced 5 to 10 inches of snow. Though most storms have produced less than 10 inches of snow, a few have produced 15 to 20 inches. Two types of winter storms generally produce heavy snows in Northampton County, assuming temperatures are cold enough: low-pressure systems that develop in the Mississippi Valley and move eastward through southern Pennsylvania, and, more frequently, deep low-pressure systems that form in the Carolinas and track northward along the east coast. Because of frequent thaws, snow does not remain for a long period, and an inch or more of snow covers the ground on an average of slightly more than 30 days in winter. The higher elevation and forest cover on the slopes of Blue Mountain, however, may stay snow covered much of the winter, especially along the ridgetop and slopes facing other than a southerly direction. After March the threat of snow tapers off rapidly, although a snowfall of as much as 3 inches has occurred in April.

The length of the growing season varies markedly because of the relief and the urban influence. On Blue Mountain the average growing season is less than 150 days; at the other extreme, the average growing season in the Bethlehem area is 195 days. The last frost in spring generally occurs the second week in April in the Bethlehem area, but it is as late as the second week in May in northern sections of the county. In one year out of 10, the last frost in spring may be as late as the last week in April in the Bethlehem area to the third week in May in the northern sections. The first frost in fall generally occurs the last week in September in northern parts of the county and the last week in October in the Bethlehem area. In one year out of 10, the first frost in fall may be as early as the third week in September in the northern sections and the second week in October in the Bethlehem area.

About 56 percent of the annual amount of precipitation received is in spring and summer. Extended periods of drought are rare. Thunderstorms occur most frequently in summer, but they occur in every month of the year. On the average, 10 thunderstorms occur in spring and five in fall, and the annual average is 36. Monthly precipitation varies greatly; in Bethlehem in October 1924 no precipitation was received, but in July 1935, the rainfall was nearly 12 inches. Once in every 2 years a 24-hour rainfall of 3 inches can be expected, and once in every 20 years a 24-hour rainfall of 5 inches is likely.

Hurricanes rarely move far enough north along the east coast to affect Northampton County to a great extent. Occasionally winds cause damage, but the heavy rains and resultant flooding is a greater concern. Severe thunderstorms and hail cause damage every year. Since 1854, when records were first kept, five tornadoes have been reported in Northampton County.

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Glossary

Alluvium. Soil material that has been deposited on land by streams.
Association, soil. A group of soils geographically associated in a characteristic repeating pattern.
Available moisture capacity. The capacity of a soil to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at the wilting point. It is commonly expressed as inches of water per inch of soil.
Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen; expressed as a percentage of the cation-exchange capacity.
Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
Cement rock. (Local) Shaly limestone used in the manufacture of cement.
Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.
Clay. As a soil separate, the mineral particles less than 0.002 millimeter in diameter. As a soil textural class, soil that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
Coarse fragments. Mineral or rock particles more than 2 millimeters in diameter.
Cobblestone. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.
Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of a steep slope.
Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard and brittle; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour or are parallel to terraces or diversions. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.
Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.
Diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and thus to protect areas downslope from the effects of such runoff.
Erosion. The wearing away of the land surface by wind (sandblast, running water, and other geological agents).
Esker (geology). A narrow, winding ridge or mound of stratified gravelly and sandy drift that was deposited by a subglacial stream.
Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors, such as light, moisture, temperature, and the physical condition of the soil are favorable.
Flagstone. A fragment of sandstone, limestone, slate, shale, or, rarely, schist, relatively thin and 6 to 15 inches long.
Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.
Foot slope. The inclined surface at the base of a hill.
Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but rich in silt or very fine sand. The layer is seemingly cemented. When dry it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has a few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.
Glacial drift (geology). Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted material deposited by streams flowing from glaciers.
Glacial outwash (geology). Cross-bedded gravel, sand, and silt deposited by melt-water as it flowed from glacial ice.
Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.
Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.
Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.
Gravel. Rounded or angular fragments of rock, up to 3 inches in diameter. An individual piece is a pebble.
High water table. A zone of saturation in the soil, within 8 inches of the surface in most seasons. It may be caused by a normal ground water table or a perched water table. The presence of a high water table is indicated by mottling within 8 inches of the surface. A high water table is associated with poorly drained and very poorly drained soils.
Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by the soil-forming processes. These are the major horizons:
O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.
A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of the following: soluble salts, clay, or sesquioxides (iron and aluminum oxides).
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A horizon to the underlying C horizon. The B horizon also has distinctive characteristics

caused (1) by accumulations of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons formed. If the material is known to be different from that in the solum, a Roman numeral preceeds the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Karst. The relief of an area underlain by limestone that dissolves intermittently to form numerous depressions or small basins.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that maybe relatively high in mineral content, finely divided, and dark in color.

Parent material. The disentegrated and partly weathered rock from which a soil has formed.

Peat. Unconsolidated soil material, largely undecomposed organic matter, that has accumulated where there has been excess moisture.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

Productivity, (of soil). The present capability of a soil for producing a specified plant or sequence of plants under a specified system of management. It is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in Ph values. A soil that tests to pH 7.0 is precisely neutral in reaction. An acid soil has a lower pH, and an alkaline soil a higher pH. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher.
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.5		

Runoff. That part of the precipitation upon a drainage area that is discharged from the area into stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but sand may be of any mineral composition. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Saprolite. Unconsolidated weathered residual material underlying the developed soil and generally grading to bedrock below.

Seasonal high water table. A zone of saturation in the soil that is within 8 to 36 inches of the surface during at least part of the year. A seasonal high water table is usually caused by a fluctuating water table generally not associated with the ground water table. It is indicated by mottling within 8 to 36 inches of the surface. It is associated with somewhat poorly drained and moderately well drained soils.

Sedimentary rock. Rock composed of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand has been consolidated into sandstone.

Series, soil. A group of soils that developed from a particular type of parent material and have genetic horizons that, except for the texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. Depression in the landscape where limestone has been locally dissolved away.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief; over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated); *prismatic* (vertical axis of aggregates longer than horizontal); *columnar* (prisms with rounded tops); *blocky* (angular or subangular); and *granular*. *Structureless* soils (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil; about 5 to 8 inches in thickness. The plowed layer.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or a sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geologic). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Valley fill. Material that was deposited in stream valleys by glacial meltwater.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

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SOIL CONSERVATION SERVICE

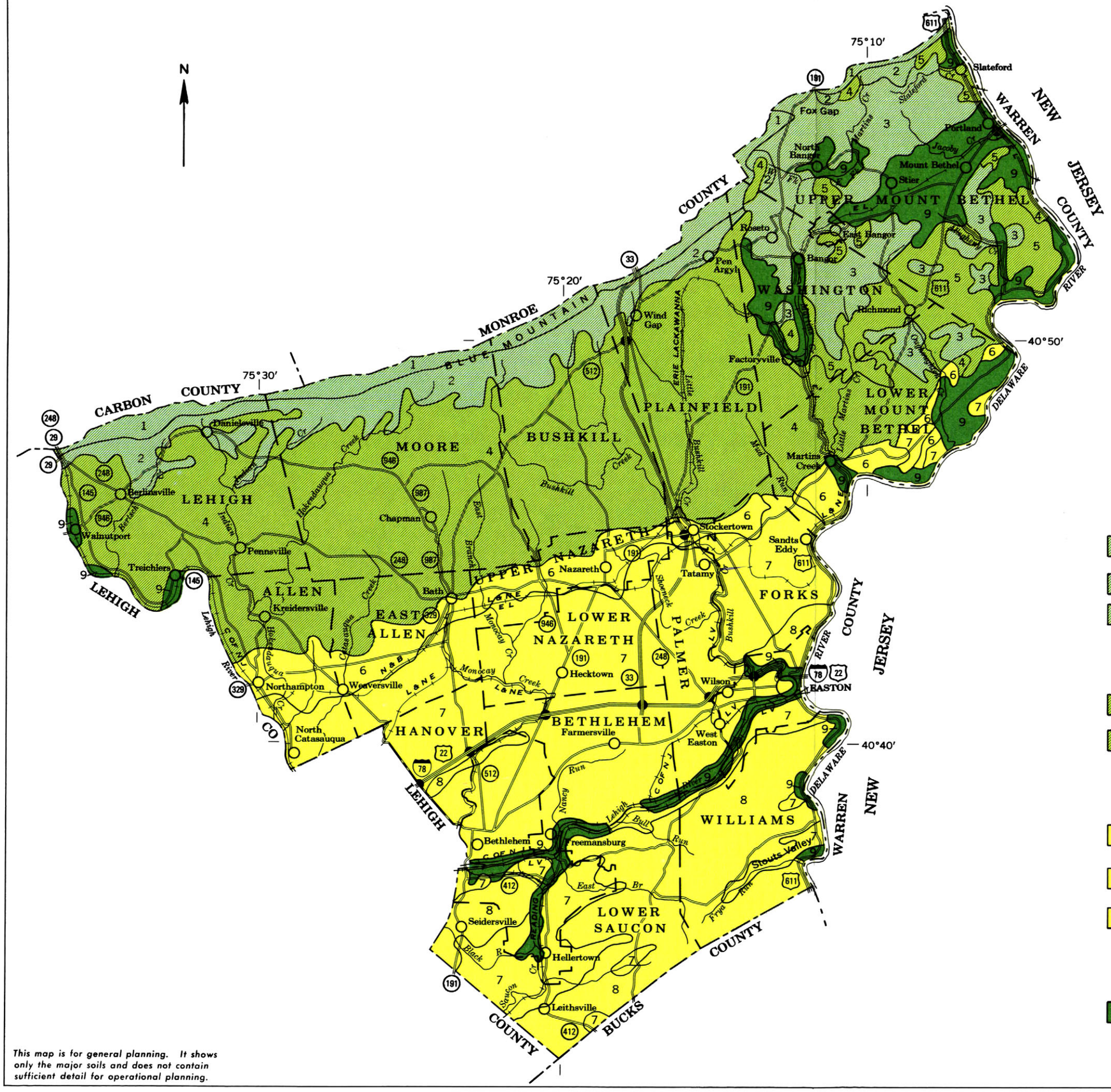
PENNSYLVANIA STATE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
AND AGRICULTURAL EXTENSION SERVICE
PENNSYLVANIA DEPARTMENT OF AGRICULTURE
STATE SOIL AND WATER CONSERVATION COMMISSION

GENERAL SOIL MAP

NORTHAMPTON COUNTY, PENNSYLVANIA

Scale 1:190,080

1 0 1 2 3 4 Miles



This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.

SOIL ASSOCIATIONS

SOILS AND LAND TYPES THAT HAVE AN EXTREMELY STONY OR GRAVELLY SURFACE LAYER AND A FIRM, COBBLY AND GRAVELLY SUBSOIL

1 — Laidig-Stony land association: Gently sloping to very steep, deep, well-drained, extremely stony soils and land types on upper mountain slopes

2 — Buchanan-Laidig-Andover association: Gently sloping to moderately steep, deep, well-drained to poorly drained soils on mountain foot slopes

3 — Swartswood-Wurtsboro-Chippewa association: Gently sloping to moderately steep, deep, well-drained to poorly drained soils on glaciated uplands

SOILS THAT HAVE A SHALY OR CHANNERY SURFACE LAYER AND A SHALY SUBSOIL

4 — Berks-Bedington-Comly association: Gently sloping to steep, moderately deep and deep, well-drained to somewhat poorly drained soils underlain by acid, gray shale

5 — Berks-Weikert association: Gently sloping to very steep, shallow and moderately deep, well-drained soils underlain by acid, gray shale

SOILS THAT HAVE A MEDIUM-TEXTURED SURFACE LAYER AND A MEDIUM-TEXTURED OR MODERATELY FINE TEXTURED SUBSOIL

6 — Duffield-Clarksburg-Ryder association: Nearly level to sloping, deep and moderately deep, well-drained and moderately well drained, silty soils underlain by shaly limestone

7 — Washington-Urban land association: Nearly level to sloping, deep, well-drained soils and land types underlain by thin glacial till over cavernous limestone

8 — Conestoga-Hollinger association: Gently sloping to steep, deep, well-drained soils underlain by granite, schist, gneiss, and quartzite

SOILS THAT HAVE A MEDIUM-TEXTURED TO MODERATELY COARSE TEXTURED SURFACE LAYER AND SUBSOIL

9 — Conotton-Red Hook-Urban land association: Nearly level to moderately steep, deep, well-drained to somewhat poorly drained soils and land types underlain by sand and gravel on terminal moraines, kames, eskers, outwash terraces, and flood plains

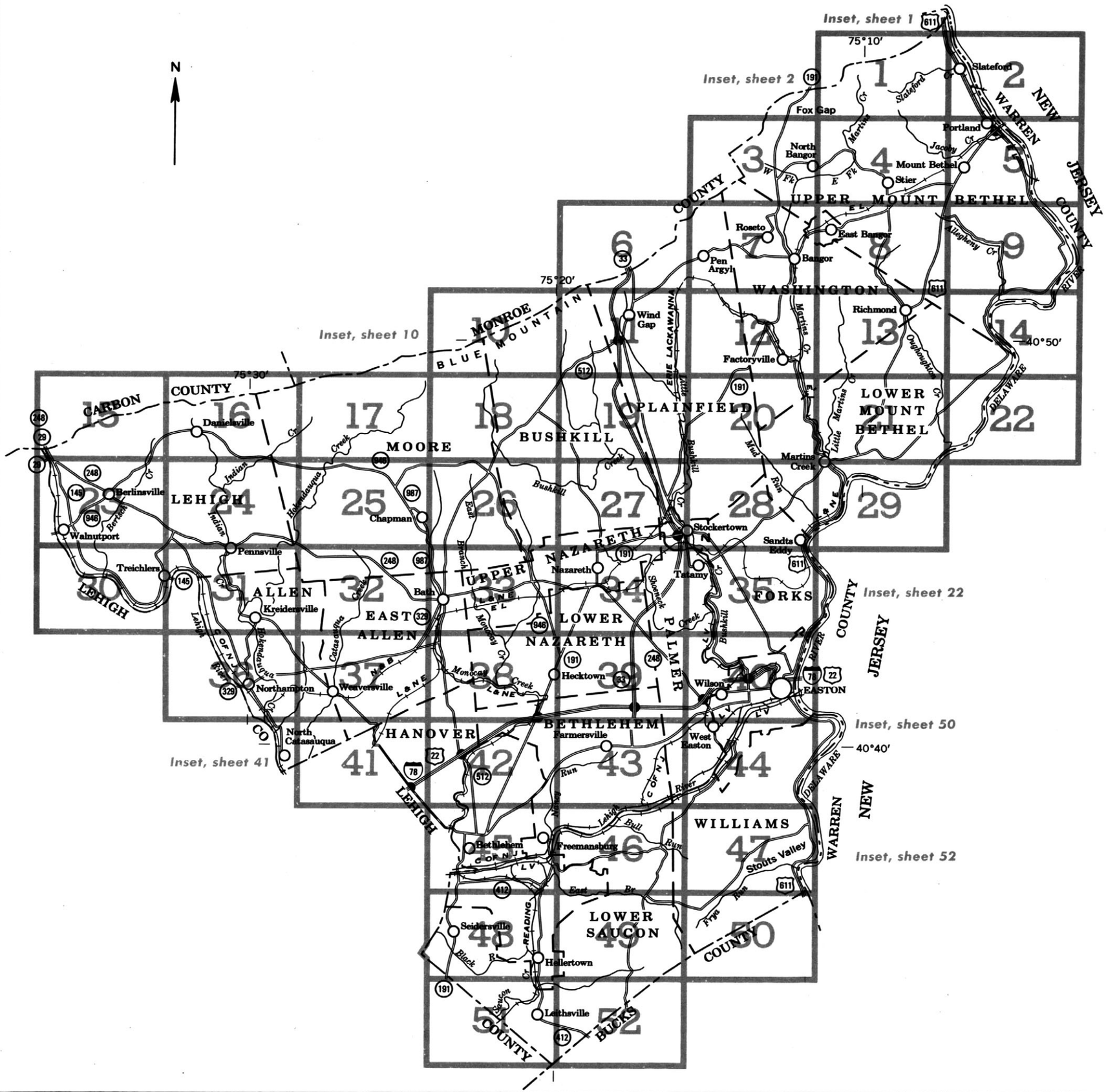
Compiled 1972

INDEX TO MAP SHEETS

NORTHAMPTON COUNTY, PENNSYLVANIA

Scale 1:190,080

1 0 1 2 3 4 Miles



GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. Refer to descriptions of capability units for interpretations concerning the common farm crops. Other interpretations are given in tables, as follows:

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page
Ad	Alluvial land, coal overwash	77	IVw-1	17
AnA	Andover gravelly loam, 0 to 3 percent slopes	78	IVw-2	17
AnB	Andover gravelly loam, 3 to 8 percent slopes	78	IVw-2	17
AoB	Andover extremely stony loam, 0 to 8 percent slopes	78	VIIs-1	17
BaB	Baile silt loam, neutral variant, 2 to 8 percent slopes	80	VIw-1	17
BeB	Baile extremely stony silt loam, neutral variant, 0 to 8 percent slopes	80	VIIs-1	17
Bg	Barbour soils	81	IIw-1	14
Bm	Barbour and Middlebury soils, high bottom	81	IIw-1	14
BnA	Bedington silt loam, 0 to 3 percent slopes	82	I-1	13
BoB	Bedington shaly silt loam, 3 to 8 percent slopes	82	IIe-2	13
BoC	Bedington shaly silt loam, 8 to 15 percent slopes	82	IIIe-1	15
BpB	Bedington extremely stony silt loam, 0 to 8 percent slopes	82	VIIs-3	18
BrA	Berks shaly silt loam, 0 to 3 percent slopes	83	IIe-3	14
BrB	Berks shaly silt loam, 3 to 8 percent slopes	83	IIe-3	14
BrC	Berks shaly silt loam, 8 to 15 percent slopes	83	IIIe-3	15
BrD	Berks shaly silt loam, 15 to 25 percent slopes	83	IVe-2	16
BsF	Berks and Weikert soils, 25 to 65 percent slopes	83	VIIe-1	17
BtA	Brinkerton silt loam, 0 to 3 percent slopes	84	IVw-2	17
BtB	Brinkerton silt loam, 3 to 10 percent slopes	84	IVw-2	17
BuB	Buchanan gravelly loam, 3 to 8 percent slopes	85	IIe-1	13
BvB	Buchanan extremely stony loam, 0 to 8 percent slopes	85	VIIs-3	18
ChA	Chippewa silt loam, 0 to 2 percent slopes	86	IVw-2	17
ChB	Chippewa silt loam, 2 to 8 percent slopes	86	IVw-2	17
CkB	Chippewa extremely stony silt loam, 0 to 8 percent slopes	86	VIIs-1	17
ClA	Clarksburg silt loam, 0 to 3 percent slopes	87	IIw-2	14
ClB	Clarksburg silt loam, 3 to 8 percent slopes	87	IIe-1	13
CmA	Comly silt loam, 0 to 3 percent slopes	87	IIw-2	14
CmB	Comly silt loam, 3 to 8 percent slopes	87	IIe-1	13
CnB	Comly extremely stony silt loam, 0 to 8 percent slopes	88	VIIs-3	18
CoB	Conestoga silt loam, 2 to 8 percent slopes	88	IIe-2	13
CoC	Conestoga silt loam, 8 to 15 percent slopes	88	IIIe-1	15
CoD	Conestoga silt loam, 15 to 25 percent slopes	88	IVe-1	16
CrB	Conestoga and Hollinger extremely stony silt loams, 0 to 8 percent slopes	88	VIIs-3	18
CrD	Conestoga and Hollinger extremely stony silt loams, 8 to 25 percent slopes	89	VIIs-3	18
CrF	Conestoga and Hollinger extremely stony silt loams, 25 to 65 percent slopes	89	VIIs-2	17
CtA	Conotton gravelly silt loam, 0 to 3 percent slopes	90	IIs-1	15
CtB	Conotton gravelly silt loam, 3 to 8 percent slopes	90	IIs-1	15
CtC	Conotton gravelly silt loam, 8 to 15 percent slopes	90	IIIe-2	15
CtD	Conotton gravelly silt loam, 15 to 25 percent slopes	90	IVe-1	16
CtF	Conotton gravelly silt loam, 25 to 65 percent slopes	91	VIIe-1	17
DuA	Duffield silt loam, 0 to 3 percent slopes	91	I-1	13
DuB	Duffield silt loam, 3 to 8 percent slopes	91	IIe-2	13
Ha	Halsey silt loam	92	IVw-2	17
HnB	Hollinger gravelly silt loam, 3 to 8 percent slopes	92	IIe-2	13
HnC	Hollinger gravelly silt loam, 8 to 15 percent slopes	92	IIIe-1	15
HnD	Hollinger gravelly silt loam, 15 to 25 percent slopes	92	IVe-1	16
Ho	Holly silt loam	93	IVw-1	17
LaB	Laidig extremely stony silt loam, 0 to 8 percent slopes	94	VIIs-3	18
LaD	Laidig extremely stony silt loam, 8 to 25 percent slopes	94	VIIs-3	18
LaF	Laidig extremely stony silt loam, 25 to 65 percent slopes	94	VIIs-2	17
Mb	Middlebury soils	95	IIw-1	14
Mu	Muck	95	VIIw-1	17
PhB	Phelps gravelly silt loam, thick solum variant, 2 to 8 percent slopes	96	IIe-1	13
Rh	Red Hook gravelly silt loam	96	IIIw-1	16
Ru	Rubble land	96	VIIIs-1	18
RyB	Ryder silt loam, 2 to 8 percent slopes	98	IIe-3	14
RyC	Ryder silt loam, 8 to 15 percent slopes	98	IIIe-3	15
St	Stony land	98	VIIIs-1	18
SvB	Swartswood gravelly loam, 2 to 8 percent slopes	100	IIs-1	15
SvC	Swartswood gravelly loam, 8 to 15 percent slopes	100	IIIe-2	15
SvD	Swartswood gravelly loam, 15 to 25 percent slopes	100	IVe-2	16
SwB	Swartswood and Wurtsboro extremely stony soils, 0 to 8 percent slopes	100	VIIs-3	18
SwD	Swartswood and Wurtsboro extremely stony soils, 8 to 25 percent slopes	100	VIIs-3	18
UrA	Urban land, nearly level	101	None	--
UrC	Urban land, sloping	101	None	--
Us	Urban land, occasionally flooded	102	None	--
UtB	Urbana silt loam, 2 to 10 percent slopes	102	IIe-1	13
VoB	Volusia gravelly silt loam, 2 to 8 percent slopes	103	IIIw-1	16
VuB	Volusia extremely stony silt loam, 0 to 8 percent slopes	103	VIIs-1	17
WaA	Washington silt loam, 0 to 3 percent slopes	104	I-1	13
WaB	Washington silt loam, 3 to 8 percent slopes	104	IIe-2	13
WaC	Washington silt loam, 8 to 15 percent slopes	104	IIIe-1	15
WaC3	Washington silt loam, 8 to 15 percent slopes, eroded	104	IVe-1	16
WaD	Washington silt loam, 15 to 25 percent slopes	104	IVe-1	16
WhF	Washington very rocky silt loam, 25 to 75 percent slopes	104	VIIs-2	17
WkB	Weikert channery silt loam, 3 to 8 percent slopes	105	IIIe-4	16
WkC	Weikert channery silt loam, 8 to 15 percent slopes	105	IVe-3	17
WkD	Weikert channery silt loam, 15 to 25 percent slopes	106	VIe-1	17
WuB	Wurtsboro gravelly silt loam, 2 to 8 percent slopes	106	IIw-2	14
WuC	Wurtsboro gravelly silt loam, 8 to 15 percent slopes	107	IIIe-2	15

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SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 3, in the symbol shows that the soil is eroded.

SYMBOL	NAME
Ad	Alluvial land, coal overwash
AnA	Andover gravelly loam, 0 to 3 percent slopes
AnB	Andover gravelly loam, 3 to 8 percent slopes
AoB	Andover extremely stony loam, 0 to 8 percent slopes
BaB	Baile silt loam, neutral variant, 2 to 8 percent slopes
BeB	Baile extremely stony silt loam, neutral variant, 0 to 8 percent slopes
Bg	Barbour soils
Bm	Barbour and Middlebury soils, high bottom
BnA	Bedington silt loam, 0 to 3 percent slopes
BoB	Bedington shaly silt loam, 3 to 8 percent slopes
BoC	Bedington shaly silt loam, 8 to 15 percent slopes
BpB	Bedington extremely stony silt loam, 0 to 8 percent slopes
BrA	Berks shaly silt loam, 0 to 3 percent slopes
BrB	Berks shaly silt loam, 3 to 8 percent slopes
BrC	Berks shaly silt loam, 8 to 15 percent slopes
BrD	Berks shaly silt loam, 15 to 25 percent slopes
BsF	Berks and Weikert soils, 25 to 65 percent slopes
BtA	Brinkerton silt loam, 0 to 3 percent slopes
BtB	Brinkerton silt loam, 3 to 10 percent slopes
BuB	Buchanan gravelly loam, 3 to 8 percent slopes
BvB	Buchanan extremely stony loam, 0 to 8 percent slopes
ChA	Chippewa silt loam, 0 to 2 percent slopes
ChB	Chippewa silt loam, 2 to 8 percent slopes
CkB	Chippewa extremely stony silt loam, 0 to 8 percent slopes
ClA	Clarksburg silt loam, 0 to 3 percent slopes
ClB	Clarksburg silt loam, 3 to 8 percent slopes
CmA	Comly silt loam, 0 to 3 percent slopes
CmB	Comly silt loam, 3 to 8 percent slopes
CnB	Comly extremely stony silt loam, 0 to 8 percent slopes
CoB	Conestoga silt loam, 2 to 8 percent slopes
CoC	Conestoga silt loam, 8 to 15 percent slopes
CoD	Conestoga silt loam, 15 to 25 percent slopes
CrB	Conestoga and Hollinger extremely stony silt loams, 0 to 8 percent slopes
CrD	Conestoga and Hollinger extremely stony silt loams, 8 to 25 percent slopes
CrF	Conestoga and Hollinger extremely stony silt loams, 25 to 65 percent slopes
CtA	Conotton gravelly silt loam, 0 to 3 percent slopes
CtB	Conotton gravelly silt loam, 3 to 8 percent slopes
CtC	Conotton gravelly silt loam, 8 to 15 percent slopes
CtD	Conotton gravelly silt loam, 15 to 25 percent slopes
CtF	Conotton gravelly silt loam, 25 to 65 percent slopes
DuA	Duffield silt loam, 0 to 3 percent slopes
DuB	Duffield silt loam, 3 to 8 percent slopes
Ha	Halsey silt loam
HnB	Hollinger gravelly silt loam, 3 to 8 percent slopes
HnC	Hollinger gravelly silt loam, 8 to 15 percent slopes
HnD	Hollinger gravelly silt loam, 15 to 25 percent slopes
Ho	Holly silt loam
LaB	Laidig extremely stony silt loam, 0 to 8 percent slopes
LaD	Laidig extremely stony silt loam, 8 to 25 percent slopes
LaF	Laidig extremely stony silt loam, 25 to 65 percent slopes
Mb	Middlebury soils
Mu	Muck
PhB	Phelps gravelly silt loam, thick solum variant, 2 to 8 percent slopes
Rh	Red Hook gravelly silt loam
Ru	Rubble land
RyB	Ryder silt loam, 2 to 8 percent slopes
RyC	Ryder silt loam, 8 to 15 percent slopes
St	Stony land
SvB	Swartswood gravelly loam, 2 to 8 percent slopes
SvC	Swartswood gravelly loam, 8 to 15 percent slopes
SvD	Swartswood gravelly loam, 15 to 25 percent slopes
SwB	Swartswood and Wurtsboro extremely stony soils, 0 to 8 percent slopes
SwD	Swartswood and Wurtsboro extremely stony soils, 8 to 25 percent slopes
UrA	Urban land, nearly level
UrC	Urban land, sloping
Us	Urban land, occasionally flooded
UtB	Urbana silt loam, 2 to 10 percent slopes
VoB	Volusia gravelly silt loam, 2 to 8 percent slopes
VuB	Volusia extremely stony silt loam, 0 to 8 percent slopes
WaA	Washington silt loam, 0 to 3 percent slopes
WaB	Washington silt loam, 3 to 8 percent slopes
WaC	Washington silt loam, 8 to 15 percent slopes
WaC3	Washington silt loam, 8 to 15 percent slopes, eroded
WaD	Washington silt loam, 15 to 25 percent slopes
WhF	Washington very rocky silt loam, 25 to 75 percent slopes
WkB	Weikert channery silt loam, 3 to 8 percent slopes
WkC	Weikert channery silt loam, 8 to 15 percent slopes
WkD	Weikert channery silt loam, 15 to 25 percent slopes
WuB	Wurtsboro gravelly silt loam, 2 to 8 percent slopes
WuC	Wurtsboro gravelly silt loam, 8 to 15 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

National or state

County

Minor civil division

Reservation

Land grant

Small park, cemetery, airport

Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

Soil boundary and symbol (Dx)

Gravel

Stoniness
- Stony
- Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

Borrow pit (B.P.)

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 1

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

2 710 000 FEET

2 725 000 FEET

605 000 FEET

600 000 FEET

604 000 FEET

2 727 000 FEET

(Joins upper right)

(Joins sheet 2)

2000-FOOT GRID TICK

(Joins inset)

(Joins inset, sheet 2)

(Joins sheet 4)

(Joins sheet 2)

595 000 FEET

2 725 000 FEET

MONROE COUNTY

WARREN COUNTY

DELAWARE RIVER

N. J.

611

UPPER MOUNT BETHEL

APPALACHIAN TRAIL

INDEFINITE BOUNDARY

KITTATINNY MOUNTAIN

Totts Gap

Martins Cr.

Slateford Creek

QUARRY

1 Mile

5000 Feet

Scale 1:15840

10

N

1 Mile 5000 Feet

Scale 1:15840

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000 Feet

2 645 000 FEET

2 665 000 FEET

550 000 FEET

552 000 FEET

560 000 FEET

2 640 000 FEET

2 650 000 FEET

APPALACHIAN TRAIL

MONROE COUNTY

BLUE MOUNTAIN

Smith Gap

BUSHKILL

Race Track

(Joins lower left)

(Joins sheet 17)

(Joins sheet 11)

(Joins inset)

(Joins sheet 18)

2000 AND 5000-FOOT GRID TICK

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 10

(11)

N

1 Mile
5000 Feet

Scale 1:15840

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 11

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 12

12

N

(Joins sheet 7)

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 20)

1 Mile

5000 Feet

Scale 1:15840

2 705 000 FEET

2 690 000 FEET

560 000 FEET

555 000 FEET

PALMER FIELD

WASHINGTON TOWNSHIP

Ackermanville

Flicksville

Factoryville

Township School

Church

Lackawanna

Waltz Creek

Warnick Creek

QUARRY

191

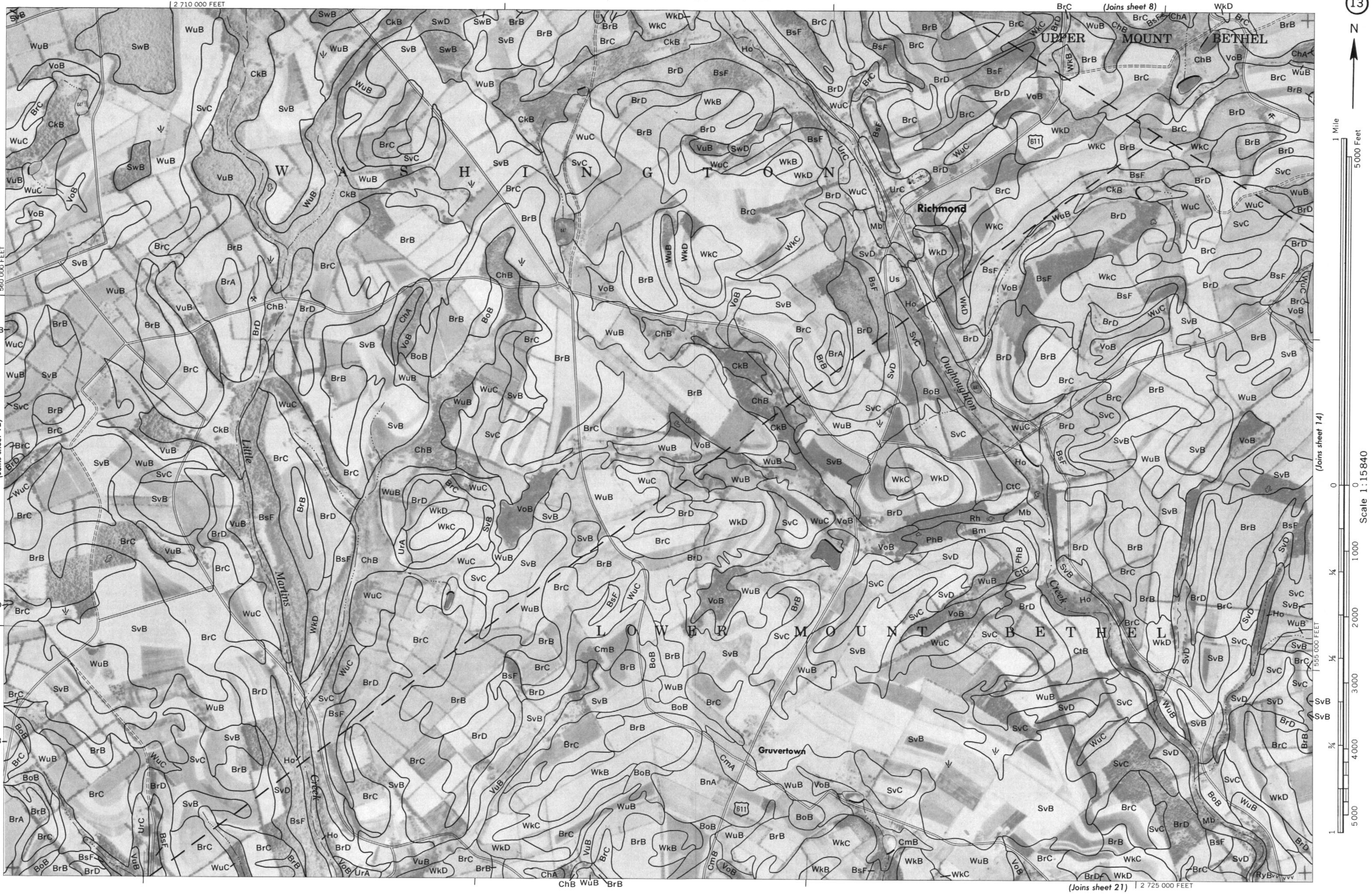
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 12

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 13

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.



NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 14

N

Scale 1:15840

1 Mile

5000 Feet

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

(15)

N

Scale 1:15840

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 15

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

16

N

1 Mile

5000 Feet

Scale 1:15840

2 630 000 FEET

545 000 FEET

540 000 FEET

2 615 000 FEET

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 24)

APPALACHIAN TRAIL

CARBON COUNTY

BLUE MOUNTAIN

Little Gap

Danielsville

Slatefield

Indian Creek

QUARRY

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service. The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 16

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 17

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

N

Scale 1:15840

1 Mile — 5000 Feet

0 — 1000 — 2000 — 3000 — 4000 — 5000

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 18

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 19

19

N

(Joins sheet 11)

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 27)

2 670 000 FEET

550 000 FEET

2 685 000 FEET

540 000 FEET

Bushkill Center

Township School

Rosleytown

Edelman

Wesley Church

Township School

Werkheiser

Bushkill Creek

Little Bushkill Creek

GOLF COURSE

QUARRY

water

PLAINFIELD

1 Mile

5000 Feet

Scale 1:15840

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 19

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

2

N

1 Mile

5000 Feet

Scale 1:15840

0 0 ¼ ½ ¾ 1

1000 2000 3000 4000 5000

(Inset, 1)

2 745 000 FEET

2 705 000 FEET

600 000 FEET

591 000 FEET

594 000 FEET

595 000 FEET

2 730 000 FEET

2 700 000 FEET

611

191

WARREN COUNTY — DELAWARE — NEW JERSEY — RIVER

MONROE COUNTY — INDEFINITE — The BOUNDARY

Offset

Little

UPPER MOUNT BETHEL

MOUNT BETHEL

Slateford

Fox Gap

APPALACHIAN TRAIL

QUARRY

RIVERVIEW CEMETERY

LACKAWAXEN

US ERIE

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 5)

3000 AND 5000-FOOT GRID TICKS

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 2

20

N

1 Mile

5000 Feet

Scale 1:15840

0 1/4 1/2 3/4 1

1000 2000 3000 4000 5000

(Joins sheet 12)

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 28)

2 705 000 FEET

550 000 FEET

540 000 FEET

2 690 000 FEET

PLAINFIELD

WASHINGTON

LOWER MOUNT BETHEL

Kesslersville

Mud Run

Martins Creek

Lehigh

QUARRY

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 20

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 21

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

22

N

1 Mile

5000 Feet

Scale 1:15840

0 0 ¼ ½ ¾ 1 1000 2000 3000 4000 5000

(Joins sheet 14)

(Joins sheet 21)

(Joins sheet 35)

2 745 000 FEET

2 711 000 FEET

550 000 FEET

520 000 FEET

515 000 FEET

540 000 FEET

2 730 000 FEET

2 710 000 FEET

1000 AND 5000-FOOT GRID TICKS

L O W E R M O U N T B E T H E L

F O R K S

CHESTNUT HILL

NEW JERSEY

DELAWARE RIVER

WARREN COUNTY

PENN CENTRAL

water

BsF BrD BrC WuB SvB SvC RyB BoB CmA CmB DuA DuB ClA CtA CtB CtC CtF UrA UrC Us Ru St Bg Mb Bm WaA WaB WaC WhF WaD CoC CoB CrF CrD 611 611

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 22

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 23 .

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service. The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

24

N

1 Mile

5 000 Feet

Scale 1:15 840

0 1 000 2 000 3 000 4 000 5 000

1/4 1/2 3/4 1

(Joins sheet 16)

(Joins sheet 23)

(Joins sheet 31)

(Joins sheet 25)

2 630 000 FEET

1 535 000 FEET

525 000 FEET

2 615 000 FEET

Salems Church

Bassards Corner

Township School

Cherryville

Howersville

Pennsville

Youngsville

Petersville

Indian Creek

Indian Creek

Hokendauqua Creek

MOORE

ALLEN HIGH

QUARRY

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 24

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 25

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 26

(26)

N

1 Mile

5000 Feet

Scale 1:15840

(Joins sheet 18)

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 33)

2 665 000 FEET

535 000 FEET

525 000 FEET

Salem Ch

FAIRVIEW CEMETERY

Moorestown

Bushkill Creek

Monocacy Creek

East Branch Monocacy Creek

QUARRY

water

UPPER NAZARETH

LAND FILL

BUSHKILL

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system: north and south zones.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 26

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 27
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

28

N

1 Mile

5000 Feet

Scale 1:15840

(Joins sheet 20)

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 35)

2 705 000 FEET

2 690 000 FEET

525 000 FEET

535 000 FEET

PLAINFIELD

LOWER MOUNT BETHEL

FORKS

Bushkill

Little Bushkill

Mud

CmB Run

Creek

LEHIGH AND NEW ENGLAND

QUARRY

Stockertown

Churchville

Uhlers

Sandts Eddy

DELAWARE RIVER

WARREN COUNTY, N J

611

BrA BrB BrC BrD BsF BoB CmA CmB ClA ClB DuA DuB Ho RyB RyC WaA WaB WaC WaD WhF WkB WkC WkD UrA Us Bm Mb

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
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NORTHAMPTON COUNTY, PENNSYLVANIA NO. 28.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 29

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 3

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 3

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 30

N

Scale 1:15840

1 Mile · ¾ · ½ · ¼ · 0

5000 Feet · 4000 · 3000 · 2000 · 1000 · 0

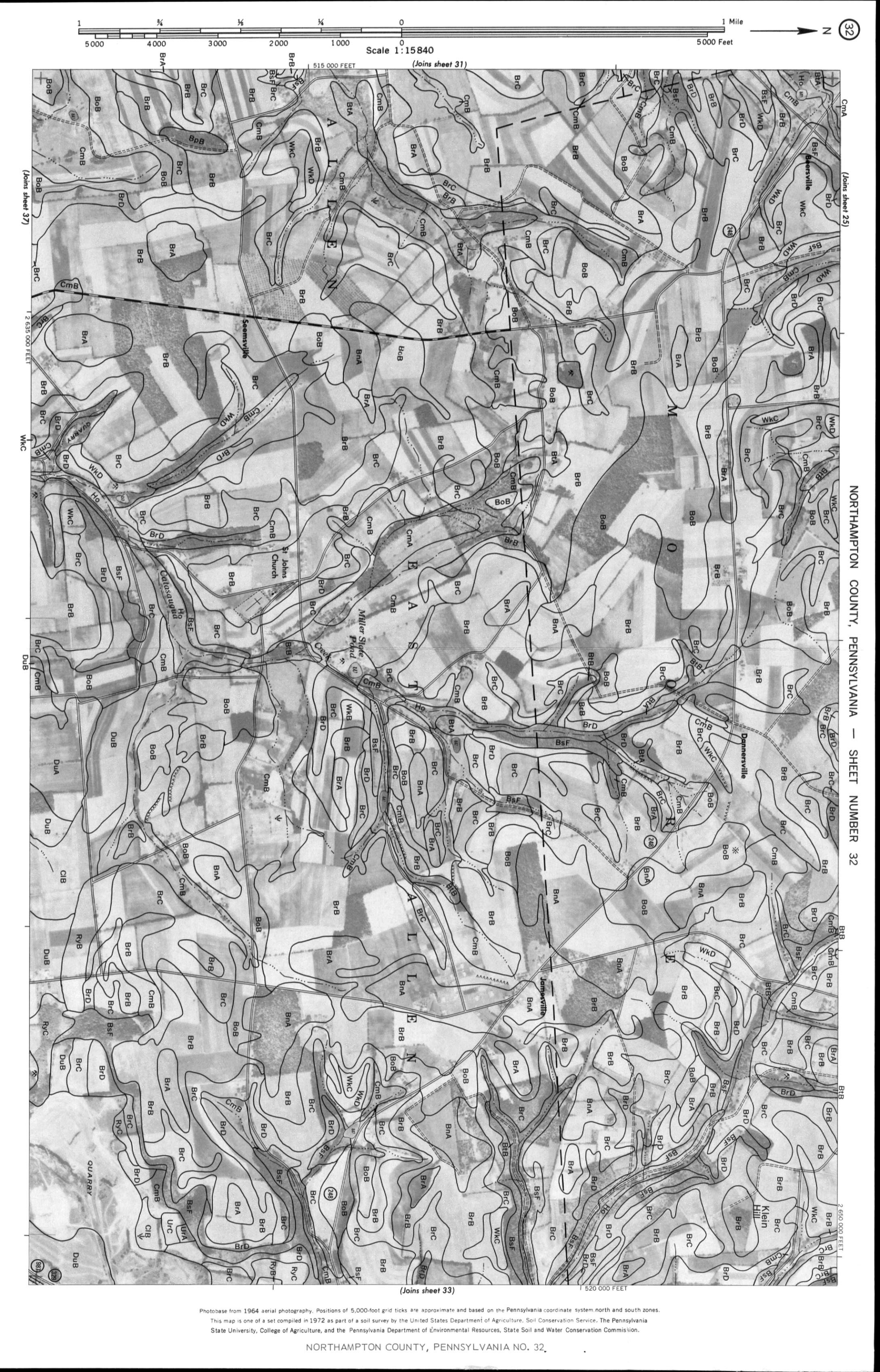
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 30

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 31

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.



Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 32

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 33

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service. The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

(Joins sheet 32)

(Joins sheet 26)

(Joins sheet 34)

(Joins sheet 38)

2 655 000 FEET

520 000 FEET

515 000 FEET

2 670 000 FEET

33

N

1 Mile

5000 Feet

Scale 1:15840

M O R E

B U S H K I L L

E A S T A L L E N

U P P E R N A Z A R E T H

L O W E R N A Z A R E T H

Holiday Hill

Bath

Bath Junction

Penn-Allen

Tadmor

Christian Springs

Georgetown

Monocacy

East Branch Monocacy Creek

Monocacy Creek

water

QUARRY

NEW ENGLAND AND LEHIGH

LACKAWANNA

ERIE

NORTHAMPTON AND BATH

L & N E

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 35

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 35

1 ¾ ½ ¼ 0 1 Mile

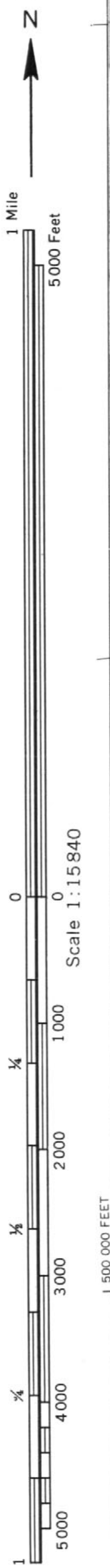
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

N

35

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 36



Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 36

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 37

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones

38

N

1 Mile

5000 Feet

Scale 1:15840

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

2 670 000 FEET

510 000 FEET

500 000 FEET

2 655 000 FEET

(Joins sheet 33)

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 42)

EAST ALLEN

LOWER NAZARETH

HANOVER

BETHLEHEM

Clyde

Smoketown

Steuben

Hanoverville

Hecktown

Brodhead

Dryland Church

HOPE CEMETERY

QUARRY

QUARRY

Monocacy Creek

East Branch

LEHIGH AND NEW ENGLAND

LEHIGH AND NEW ENGLAND

DuB RyC WaA WaB WaC3 CIA CIB CmA Ho UrA WaC WaD

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

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NORTHAMPTON COUNTY, PENNSYLVANIA NO. 38

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 39

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Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 4

4

N

1 Mile

5000 Feet

Scale 1:15840

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 8)

(Joins sheet 5)

2 725 000 FEET

590 000 FEET

580 000 FEET

2 710 000 FEET

Jacoby Creek

Martins Creek

East Fork

Lake Poco

Echo Lake

Stier

GRAVEL PIT

QUARRY

PIT

GRAVEL

LACKAWANNA

ERIE

611

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
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NORTHAMPTON COUNTY, PENNSYLVANIA NO. 4

40

N

1 Mile

5000 Feet

Scale 1:15 340

(Joins sheet 35)

(Joins sheet 39)

(Joins sheet 44)

(Joins inset, sheet 50)

2 705 000 FEET

510 000 FEET

500 000 FEET

2 690 000 FEET

FORKS

CHESTNUT HILL

PALMER

WILSON

EASTON
(county seat)

SOUTH EASTON

WILLIAMS

Coilton

Walters

Palmer Heights

ARNDTS & MESSINGER CEMETERY

EASTON HEIGHTS CEMETERY

Hospital

Easton High School

Bushkill Creek

LEHIGH VALLEY

LEHIGH RIVER

DELAWARE RIVER

NEW JERSEY

WARREN COUNTY

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

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NORTHAMPTON COUNTY, PENNSYLVANIA NO. 40

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 41

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service. The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

(Joins inset)

2 635 000 FEET

495 000 FEET

3000 AND 5000-FOOT GRID TICKS

(Joins sheet 37)

STATE HOSPITAL FARM

GOLF COURSE

Catasauqua Creek

LEHIGH COUNTY SURVEY BOUNDARY

PUBLISHED LEHIGH COUNTY SURVEY BOUNDARY

NORTH CATASAUQUA

EAST ALLEN

ALLEN

HANOVER

Schoenersville

NEW ENGLAND AND LEHIGH

2 627 000 FEET

(Joins sheet 36)

NORTHAMPTON

QUARRY

ALLEN UNION CEMETERY

CENTRAL RR OF NEW JERSEY

HOLY TRINITY CEM

LEHIGH COUNTY

LEHIGH RIVER

NORTH CATASAUQUA

LEHIGH CO PUB SURVEY BOY

(Joins upper left)

490 000 FEET

2 630 000 FEET

(Joins sheet 42)

LEHIGH COUNTY

Westgate Hills

2 650 000 FEET

41

N

1 Mile

5 000 Feet

Scale 1:15840

(Joins sheet 38)

N

Scale 1:15840

1 Mile | 5 000 Feet | 0 | 1000 | 2000 | 3000 | 4000 | 5000

(Joins sheet 41)

(Joins sheet 43)

(Joins sheet 45)

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 43

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

2 675 000 FEET

495 000 FEET

(Joins sheet 42)

(Joins sheet 39)

(Joins sheet 44)

(Joins sheet 46)

2 690 000 FEET

43

N

1 Mile

5000 Feet

Scale 1:15840

490 000 FEET

Notre Dame High School

Farmersville

St Johns Church

Township School

COUNTRY CLUB

GETHSEMANE CEMETERY

Prospect Park

Highland Park

Butztown

Wagnerville

Miller Heights School

HOLY GHOST CEMETERY

BETHLEHEM-EASTON AIRPORT

Hopeville

LOWER SAUCON

WILLIAMS

Middletown

LAND FILL

Nancy Run

Island Park

BETHLEHEM

CENTRAL OF NEW JERSEY

LEHIGH VALLEY RIVER

NEW JERSEY CENTRAL

LEHIGH

N

1 Mile 5000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1 0 1000 2000 3000 4000 5000

(Joins sheet 40)

2 705 000 FEET

(Joins inset, sheet 50)

495 000 FEET

490 000 FEET

(Joins sheet 34)

(Joins sheet 47)

2 695 000 FEET

WEST EASTON

SOUTH EASTON

PALMER

MORGAN

WILLIAMS

Highland Park

Glendon

Morgan Valley

Island Park

Whippoorwill Is

Avona School

Livingston School

Webster School

HAYS CEMETERY

ST JOSEPH CEMETERY

ST MAGDALEN CEMETERY

ST ANTHONYS CEMETERY

QUARRY

GRAVEL PIT

NEW JERSEY GRAVEL PIT

LAND FILL

water

LEHIGH VALLEY

CENTRAL OF NEW JERSEY

LEHIGH RIVER

DELAWARE RIVER

NEW JERSEY

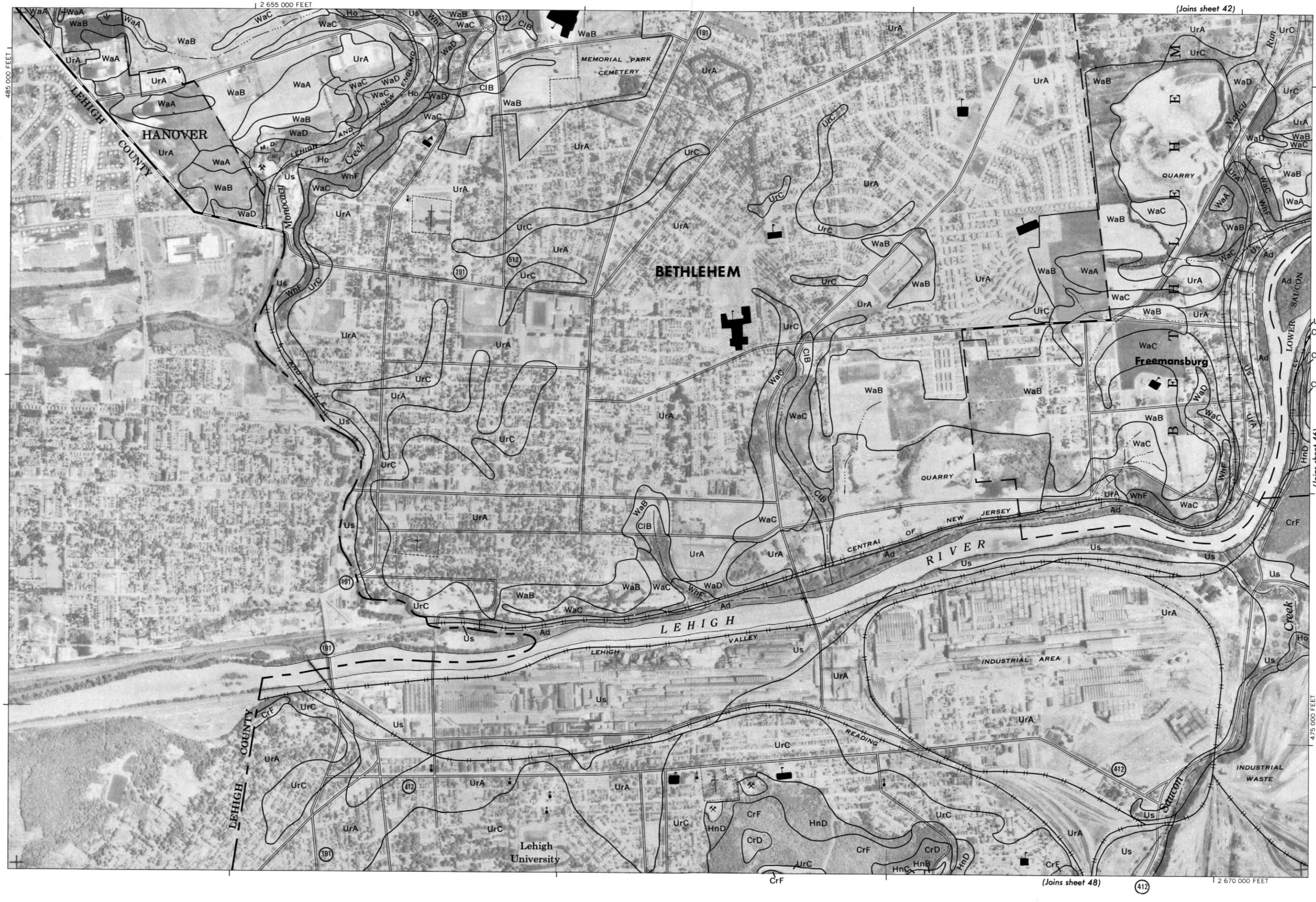
WARREN COUNTY

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 44

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 45

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service. The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.



(Joins sheet 43)

2 690 000 FEET

1 485 000 FEET

N

1 Mile

5000 Feet

Scale 1:15840

0 1/4 1/2 3/4 1

1000 2000 3000 4000 5000

(Joins sheet 45)

(Joins sheet 47)

475 000 FEET

(Joins sheet 49)

2 675 000 FEET

Middletown

Bethlehem Boating Club

Redington

Steel City

Shimersville

BETHLEHEM

BETHLEHEM

LOWER SAUCON

WEST

LEHIGH RIVER

NEW JERSEY CENTRAL RR

LEHIGH VALLEY RR

Bull Run

Green Hill

East Branch Saucon Creek

QUARRY

LAND FILL

SAND PIT

INDUSTRIAL WASTE

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 46

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 47

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

(48)

N

1 Mile

5 000 Feet

Scale 1:15840

(Joins sheet 45)

2 670 000 FEET

470 000 FEET

460 000 FEET

2 655 000 FEET

(Joins sheet 49)

(Joins sheet 51)

BETHLEHEM

Lehigh University

Research Center

Lehigh University Athletic Field

Seidersville

Wydnor

HELLERTOWN

LOWER SAUCON

SOUTH MOUNTAINS

LEHIGH COUNTY

INDUSTRIAL WASTE

Saucon Creek

Black River

Quarry

Reading

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 48

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 49

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service. The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 52)

(Joins sheet 50)

2 675 000 FEET

470 000 FEET

2 690 000 FEET

465 000 FEET

BETHLEHEM

HELLERTOWN

Kirchberg

Swoveberg

Focht Hill

Granite Hill

LOWER SAUCON

WILLISTOWN

BUCKS COUNTY

Lower Saucon

Wassergass

INDUSTRIAL WASTE

East Branch Saucon Creek

Marlin Lake

Campbell Pond

Saucona Pond

Hellertown Reservoir

Christ Church

ST JOSEPHS CEMETERY

St Lukes Church

Lower Saucon School

Lost River Caverns

GOLF COURSE

1 Mile

5000 Feet

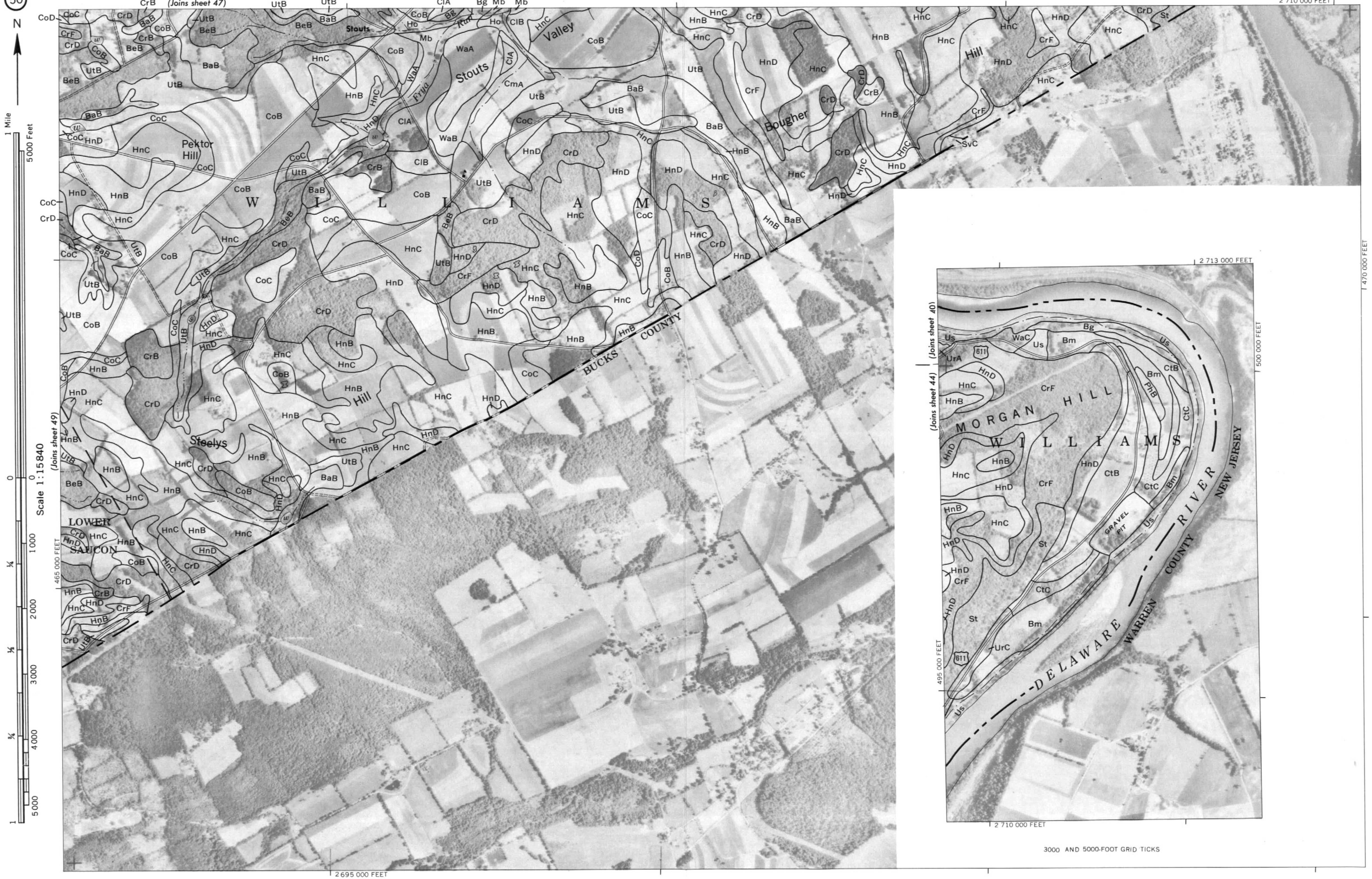
Scale 1:15840

N

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 5

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 50



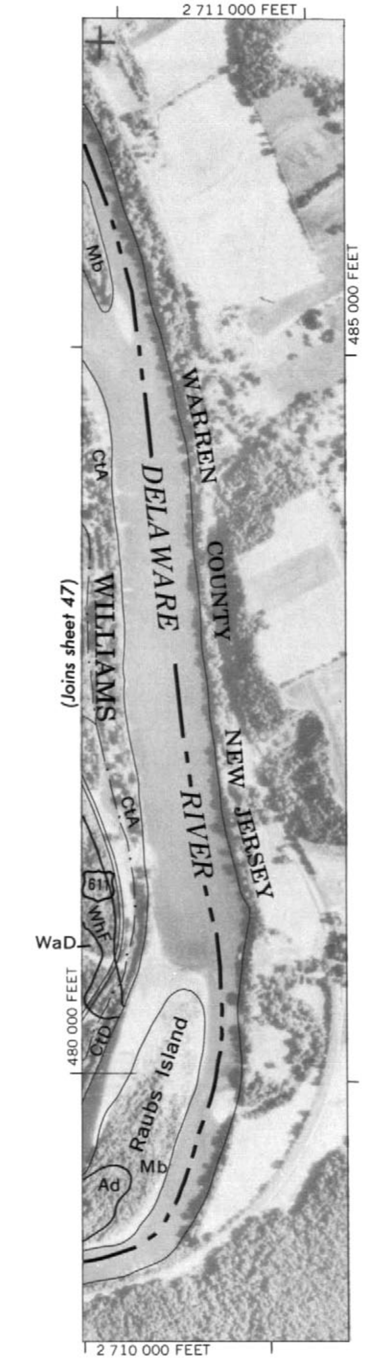
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 50

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 51

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.
Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 52



10000 AND 5000-FOOT GRID TICKS

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 6

6

N

1 Mile

5000 Feet

Scale 1:15840

0 0 1000 2000 3000 4000 5000

¼ ⅛ ½ ¾ 1

2 685 000 FEET

575 000 FEET

565 000 FEET

2 670 000 FEET

MONROE COUNTY

MOUNTAINTOP

DELAWARE

BUSHKILL

APPALACHIAN TRAIL

Wind Gap

PEN ARGYL

West Pen Argyl

LACKAWANNA

ERIE

QUARRY

LaB LaD LaF St Ru UrA UrC BpB BoB BoC BuB BvB CmA CnB MdB BrA BrB WkB WkC WkD

(Joins sheet 7)

(Joins sheet 11)

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

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NORTHAMPTON COUNTY, PENNSYLVANIA NO. 6

7

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 7

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Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system, north and south zones.

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 8

(Joins sheet 4)

2 725 000 FEET

575 000 FEET

(Joins sheet 9)

N

1 Mile

5000 Feet

Scale 1:15840

0 1000 2000 3000 4000 5000 FEET

(Joins sheet 7)

(Joins sheet 13)

2 710 000 FEET

565 000 FEET

LACKAWANNA

ERIE

water

QUARRY

East Bangor

Five Points

Mount Airy

Stone Church

UNION CEMETERY

Oughoughton Creek

U P P E R M O U N T B E T H E L

W A S H I N G T O N

611

Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.

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NORTHAMPTON COUNTY, PENNSYLVANIA NO. 8

NORTHAMPTON COUNTY, PENNSYLVANIA — SHEET NUMBER 9

(9)

(Joins sheet 5)

N

Scale 1:15840

1 Mile

5000 Feet

NORTHAMPTON COUNTY, PENNSYLVANIA NO. 9

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Photobase from 1964 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Pennsylvania coordinate system north and south zones.